Study of avian cestode parasites and ecological observation of fowls in Jhansi

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By

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WORK IS DEDICATED

IN THE MEMORY OF

MY BELOVED

FATHER

CONTENTS

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CERTIFICATE

This is to certify that the thesis entitled, "STUDY OF AVIAN CESTODE PARASITES AND ECOLOGICAL OBSERVATION OF FOWLS IN JHANSI" embodies the original research work of Mr. Brajesh Kumar Srivastava, who worked under the guidance of undersigned during 1987-1989 in the Department of Zoology, Bipin Behari College, Jhansi. The thesis has not been submitted for any degree to any other University.

A Srivastav

Date 3.7.89

(Dr. A.K. SRIVASTAV)

PART - A

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INTRODUCTION

A number of domestic and wild species of birds constitute highly nutritive food for human beings. Some of them are considered as delicacies. Their eggs are also relished as nutritive food. However, these edible birds are known to harbour a number of cestode, trematode and nematode parasites which cause deterioration in their health and hence their nutritive and market value is affected. The curiosity of the author to know about the helminth parasites found in such birds lead him to undertake the present project. In the present thesis the author has restricted himself to the nature of infection of cestode parasites only. With a view to know the nature and extent of cestode infection regular studies were undertaken to record the nature of parasitism in the domestic fowl, Gallus gallus (Linnaeus) for two successive years. To have the idea of the state of cestode infection in the avian hosts in Bundelkhand region the survey was conducted in different parts of district Jhansi including its suburbs. The present thesis deals with some of the interesting cestodes obtained during the survey which include the description of two new genera, one new subgenus, nineteen new species and redescription of two old species.

The new genera, new subgenus and new species belong to the family Anoplocephalidae, Davaineidae, Dilepididae, Hymenolepididae, Amabiliidae and Dioecocestidae of the order Cyclophyllidea.

A brief review relating to the cestode genera described in the thesis is given below:

The genus Killigrewia Meggitt, 1927 contains ten species from the whole world, the first report of the genus pertains to Killigrewia delafondi Railliet, 1892 from Columba domestica in France. Out of the seven oriental species four have been reported from Indian subcontinent. The first report of the genus from the Indian subcontinent is that of Meggitt, 1927. Other workers who have contributed to the knowledge of this genus from Indian subcontinent are Sharma, 1943; Johri, 1962 and Srivastava and Capoor, 1965.

The new genus Doublesetina represents the subfamily Linstowiinae Fuhrmann, 1907 of the family Anoplocephalidae Cholodkovsky, 1902. So far seven genera have been reported from the subfamily Linstowiinae Fuhrmann, 1907 from the whole world. Out of them two genera have been reported from the avian hosts while five genera from mammalian hosts. The present new genus is the third genus from bird host and first from Indian subcontinent and the oriental region.

The genus *Cotugnia* Diamare, 1893 is currently represented by thirtytwo species from Indian subcontinent, thirtyfive from the oriental region and fortytwo from the whole world. The first report of the genus pertains to *Cotugnia diagnophora* (Pasquali, 1890) from the domestic fowl. The first report of the genus from Indian subcontinent is that of *Cotugnia browni* Smith, Fox and White, 1908 in *Palaeornis fasciatus* and *Plaeonis eupatria* from Ceylon and Burma. The other workers who have contributed to the knowledge of this genus from Indian subcontinent are Fuhrmann, 1909; Baczynska, 1914; Beddard, 1916; Meggitt, 1920, 1924, 1926; Baer, 1925; Johri, 1934; Yamaguti, 1935; Burt, 1940; Mudaliar, 1943; Singh, 1952; Malvia and Dutt, 1969; Mukherjee, 1970 and Srivastav and Capoor, 1984, 1985.

The genus *Davainea* Blanchard, 1891 is currently reported by five species from the Indian subcontinent, five from the oriental region and fifteen species from the whole world. The first report of the genus pertains to *Davainea proglottina* (Davaine, 1860). Singh, 1952 reported the occurrence of *Davainea himantopodis* (Johnston, 1911) in *Himantopus himantopus* from Lucknow, India. Other workers who have contributed to the knowledge of this cestode genus are Shinde, 1969; Dhawan and Capoor, 1972; Shinde and Ghare, 1977 and Bhalya and Capoor, 1987.

Currently nineteen species of the subgenus Fuhrmannetta Stiles et Orlemann, 1926 have been reported from the whole world. Out of them six species have been reported from the Indian subcontinent and oriental region. The first report of the subgenus pertains to Raillietina (Fuhrmannetta) crassula Rudolphi, 1819. The first report of the subgenus from Indian subcontinent is that of Raillietina (Fuhrmannetta) echinobothrida Megnin, 1880 in domestic fowl from Berhampur, Bengal. Other workers who have contributed to the knowledge of this cestode subgenus from Indian subcontinent are Joyeux and Houdemer, 1928 and Srivastava and Srivastav, 1988.

According to Sawada, 1964 tapeworms belonging to Raillietina (Paroniella) amount to fortyeight species, out of which thirty species have been described from the oriental region, including sixteen from Indian subcontinent. The first report of the subgenus pertains to Raillietina (Paroniella) urogalli (Modeer, 1790) in Tetrao urogallus, Lagopus scoticus, Tetraogallus himalayensis, Lyrurus tetrix, Caccabis saxatilis, Perdix graeca from Europe and West Siberia. The first report of the subgenus from Indian subcontinent is that of Raillietina (Paroniella) cruciata Rudolphi, 1819 from Brachypterus aurantiacus. Other workers who have contributed to the knowledge of this cestode subgenus are Clerc, 1906; Fuhrmann, 1905, 1908; Meggitt, 1926, 1931, 1933; Subramanian, 1928; Johri, 1939; Moghe et Inamdar,

1934; Sharma, 1943; Srivastava and Sawada, 1980 and Srivastava *et al*., 1988.

The genus *Amoebotaenia* Cohn, 1900 includes six species from Indian subcontinent, eight from the oriental region and twenty from the whole world. The first report of the genus is that of *Amoebotaenia cuneata* Linstow, 1872 which is common in the Indian subcontinent also. The first report from the Indian subcontinent is that of *Amoebotaenia setosa* Burt, 1940 in *Lobipluvia malabarica* from Ceylon. Other workers who have contributed to the knowledge of these cestodes are Shinde, 1972; Kalyankar and Palladwar, 1977; Srivastava, 1979; Dixit and Capoor, 1981; Srivastava *et al*., 1983 and Srivastava and Srivastav, 1987.

The author in the present work divides the genus *Clelandia* Johnston, 1909 into two subgenera on the basis of arrangement of genital pore viz., *Clelandia* (*Clelandia*) n. subgenus and *Clelandia* (*Podicollis*) n. subgenus. The first and the only report of the genus pertains to that of *Clelandia parva* Johnston, 1909 in *Xenorhynchus asiaticus*. The present new species, *Clelandia* (*Podicollis*) *sawadai* n.sp. represents the first report of the subgenus from the Indian subcontinent and the oriental region.

The genus *Neoliga* Singh, 1952 comprises eight species from the whole world. Out of them six have been

reported from the Indian subcontinent and the oriental region. The first report of the genus pertains to that of *Neoliga diplacantha* Singh, 1952 in *Micropus affinis* from India. Other workers who have contributed to the knowledge of these cestodes are Shinde, Jadhav and Kadam, 1981.

The genus *Anoncotaenia* Cohn, 1900 comprises eighteen species from the whole world. Out of the various species of the genus three species have been reported from the Indian subcontinent which represent the oriental species. The first report of the genus pertains to *Anoncotaenia globata* (Linstow, 1879) from Europe. The first report from the Indian subcontinent pertains to *Anoncotaenia dendrocitta* (Woodland, 1929) in *Dendrocitta rufa* and *Dendrocitta vagabunda* from India. Other workers who have contributed to the knowledge of the cestode genus are Singh, 1952, 1964 and Sharma and Mathur, 1987.

Currently nine species of the genus *Neyraia* Joyeux *et* David, 1934 have been reported from the whole world. Out of them six have been reported from the Indian subcontinent and the oriental region. The first report of the genus pertains to that of *Neyraia intricata* Krabbe, 1879 in *Upupa epops*. The first report of the genus from Indian subcontinent is that of Shinde, 1972. Other workers who have contributed to the knowledge of these cestodes are Srivastav, 1980 and Pandey and Chaudhary, 1982.

The genus Armadoskrjabinia Spassky et Spasskaja, 1954 contains as many as seven species from the whole world which includes one from the Indian subcontinent and the oriental region. The first report of the genus pertains to that of Armadoskrjabinia rostellata (Abildgaard, 1790). The first report of the genus from the Indian subcontinent is that of Armadoskrjabinia medici (Stossich, 1890) Spassky et Spasskaja, 1954. Armadoskrjabinia nyrocai n.sp. described herewith represents the second species of the genus from the Indian subcontinent and the oriental region.

The genus Decacanthus Yamaguti, 1959 comprises single species, Decacanthus arcticus (Schiller, 1955) n.comb., Syn. Hymenolepis arcticus in Somateria spectabilis, Somateria mollissima, Arctonetta fishcheri from Alaska. Decacanthus bundelensis n.sp. described herewith represents the first report of the genus from the Indian subcontinent and the oriental region.

The genus Drepanidotaenia Railliet, 1892 is represented by sixteen species from the whole world. Only one species Drepanidotaenia oweni was reported in Philomachus pugnax from India by Moghe, 1933 but Yamaguti, 1959 transferred it to the genus Echinocotyle. Thus so far only one species, Drepanidotaenia sinhai Pande, 1983 (unpublished) has been reported from the Indian subcontinent. Hence the

present form *Drepanidotaenia pandei* n.sp. is the second report of the genus from Indian subcontinent and the oriental region.

The genus *Mayhewia* Yamaguti, 1956 contains as many as twenty two species from the whole world which includes six from the Indian subcontinent and the oriental region. The first report of the genus pertains to that of *Mayhewia crenata* (Goeze, 1782) in *Picus major* and *Gecinus viridis* from Europe. The first report of the genus from the Indian subcontinent is that of *Mayhewia clerci* (Fuhrmann, 1920). Other workers who have contributed to the knowledge of the cestode genus are Meggitt, 1933; Singh, 1952 and Chishti and Khan, 1982.

The new genus *Proterandria* represents the family Amabiliidae Fuhrmann, 1908. So far only three genera have been reported from the family Amabiliidae Fuhrmann, 1908 from the whole world. Out of them one genus has been reported from the oriental region and Indian subcontinent. The present new genus and the new species is the second from the Indian subcontinent and the oriental region.

The genus *Dioecocestus* Fuhrmann, 1900 contains as many as seven species from the whole world. The first report of the genus pertains to that of *Dioecocestus asper* (Mehlis, 1831) from Europe. The only report from the Indian sub-

continent and the oriental region is that of Dioecocestus fevita Meggitt, 1933. Dioecocestus indica n.sp. described herewith represents the second species of the genus from the Indian subcontinent and the oriental region.

The genus Infula Burt, 1939 comprises three species from the whole world. The first report of the genus pertains to that of Infula burhini Burt, 1939 from Australia. Singh, 1952 also reported the occurrence of Infula burhini (Burt, 1939) from Lucknow, India. Other worker who has contributed to the knowledge of this genus is Johri, 1959. Infula limosai n.sp. described herewith represents the second species of the genus from the Indian subcontinent.

The genus Hymenocoelia Capoor and Srivastava, 1964 comprises single species, Hymenocoelia chauhani in Columba livia (G.) which has been reported from the Indian subcontinent and the oriental region. Hymenocoelia liviana n.sp. described herewith represents the second species of the genus from the Indian subcontinent and the oriental region.

With a view to discover the cestode host relationships, examination of the fowls, Gallus gallus (Linnaeus) has been performed for two successive years. The Prevalence, Mean intensity and Relative density of cestode infection has been worked out, in relation to the body weight, alimentary canal weight and the sex of the host.

HISTORICAL

Several workers have contributed to the knowledge of cestode taxonomy from the Indian subcontinent. Southwell's contribution has been classical. Apart from his classical volume of fauna of British India, his pioneering contributions include the descriptions of many new species. In 1913 Southwell reviewed the cestode material then existing in the Indian museum collection. The review included the description of twenty species and the redescription of some known species. The other important contributions of Southwell from avian hosts include Tetrabothrius erostris (1916), Paradilepis kempi (1921), Dicranotaenia annadalei (1922), Raillietina (R.) fuhrmanni (1922), Raillietina (S.) centropi (1922), Spiniglans microsoma (1922), Parvirostrum magnisomum (1930), Raillietina (F.) korkei (1930) and Raillietina (F.) maplestonei (1930). It will not be an exaggeration to say that his contributions gave great stimulus and a direction to the study of cestodes in this subcontinent and its neighbourhood.

Meggitt's studies comprised forms mainly from Burma and included Cotugnia fastigata (1920), Hottuynia linstowi (1921), Cotugnia cuneata var. nervosa (1924), Cotugnia tenuis (1924), Raillietina (R.) parviuncinata (1924 with Saw), Raillietina (R.) torquata (1924), Cotugnia

seni (1924), Paricterotaenia barbara (1926), Paricterotaenia innominata (1926), Paricterotaenia magnicirrosa (1926), Raillietina (F.) birmanica (1926), Raillietina (F.) pseudo-echinobothrida (1926), Raillietina (P.) facilis (1926), Raillietina (P.) reynoldsae (1926), Raillietina (R.) flaccida (1926), Staphylepis rustica (1926), Amoebotaenia frigida (1927), Anomotaenia dubia (1927), Anomotaenia fortunata (1927), Armadoskrjabinia magniuncinata (1927), Choanotaenia aegyptica (1927), Cotugnia fleeri (1927), Cotugnia polycantha var. paucimusculosa (1927), Diorchis longicirrosus (1927), Echinocotyle birmanica (1927), Hispaniolepis falsata (1927), Killigrewia frivola (1927), Killigrewia pamelae (1927), Liga facilis (1927), Nadejdolepis magnisaccis (1927), Paradilepis ficticia (1927), Paricterotaenia falsificata (1927), Raillietina (R.) famosa (1927), Raillietina (R.) flabralis (1927), Biuterina fallax (1928), Cotugnia fila (1931), Mesocestides tenuis (1931), Raillietina (R) fecunda (1931), Raillietina (R.) flaminata (1931), Raillietina (R.) fragilis (1931), Raillietina (R.) pseudocrytus (1931), Dioecocestus fevita (1933), Mayhewia filta (1933), Passerilepis fola (1933) and Raillietina (P.) fulvia (1933).

The important contributions of Moghe from avian hosts comprises Panuwa chandleri (1925), Raillietina (R.) nagpurensis (1925), Raillietina (R.) quadritesticulata (1925), Southwellia gallinarum (1925), Baeria orbiuterina (1933), Echinocotyle oweni (1933), Ophryocotyloides meggitti

(1933), Unciunia acapillicirrosa (1933), Ophryocotyloides monacanthis (1934 with Inamdar), Paruterina septotesticulata (1934 with Inamdar), Raillietina (P.) duosyntesticulata (1934 with Inamdar), Raillietina (P.) molpastina (1934 with Inamdar). He erected two new genera Southwellia (1925) and Baeria (1933).

The investigations of Johri, L.N. ranged over Burma and several parts of India. His important contributions comprise Paruterina meggitti (1931), Raillietina (R.) perplexa (1933), Cotugnia januaria (1934), Cotugnia noctua (1934), Eugonodaeum ganieum (1934), Eugonodaeum testifrontosa (1934), Gidhaia indica (1934), Oligorchis hieraticos (1934), Raillietina (S.) kakia (1934), Raillietina (R.) penetrans var. nova (1934), Haploparaxis kamayuta (1935), Cotugnia longicirrosa (1939), Diorchis alvedea (1939), Diorchis chalcophapsi (1939), Diorchis lintoni (1939), Raillietina (P.) symonsii (1939), Microsomacanthus gyogonka (1941), Oligorchis burmanensis (1941), Eugonodaeum burmanense (1951), Eugonodaeum bybralis (1951), Thaparea magnivesicula (1953), Hymenolepis jasuta (1960), Hymenolepis jerralta (1960), Hymenolepis longiovata (1962) and Killigrewia indica (1962). Johri established two new genera viz., Gidhaia (1934) and Thaparea (1953).

Inamdar's contributions include Malika pittae (1933), Choanotaenia gondwana (1934), Similuncinus totani ochropodis

(1934), *Shipleya ferrani* (1942) and *Ophryocotyloides bhaleroi* (1944).

Burt studied cestodes from Sri Lanka and his researches of forty years covered a very wide range and included descriptions of numerous forms including *Angularella magniuncinata* (1938), *Angularella minutiuncinata* (1938), *Notopentorchis collocaliae* (1938), *Pseudangularia thompsoni* (1938), *Pseudangularia triplacantha* (1938), *Pseudochoanotaenia collicaliae* (1938), *Infula burhini* (1939), *Paronia biuterina* (1939), *Paronia calcauterina* (1939), *Paronia coryllidis* (1939), *Amoebotaenia setosa* (1940), *Choanotaenia dispar* (1940), *Choanotaenia magnihamata* (1940), *Cotugnia magna* (1940), *Cotugnia polytelidis* (1940), *Kowalewskiella glareolae* (1940), *Kowalewskiella stagnatilidis* (1940), *Malika kalawewaensis* (1940), *Malika zeylanica* (1940), *Microsomacanthus childi* (1940), *Onderstepoortia burhini* (1940), *Onderstepoortia lobipulviae* (1940), *Panuwa lobivanelli* (1940), *Paricterotaenia tringae* (1940), *Parvitaenia ardeolae* (1940), *Raillietina (S.) caprimulgi* (1940), *Dicranotaenia ellisoni* (1944), *Dicranotaenia uragahaensis* (1944), *Krimi chrysocolaptis* (1944), *Passerilepis septemsororum* (1944). Burt erected following new genera viz., *Pseudangularia* (1938), *Pseudochoanotaenia* (1938), *Notopentorchis* (1938), *Infula* (1939), *Panuwa* (1940) and *Krimi* (1944) from avian hosts. Some of Burt's species have been reported from India also.

Sharma (1943) contributed following cestodes from Nepal, Dicranotaenia aspicaris, Hispaniolepis kaiseris Hymenosphenacanthus meggitti, Hymenosphenacanthus rangoonicus, Microsomacanthus jamunicus, Raillietina (P.) nepalis, Raillietina (P.) parbata, Raillietina (R.) chilmei, Raillietina (R.) kantipura, Raillietina (R.) nripendra, Raillietina (R.) dhuncheta and Staphylepis infrequence.

Singh, K.S. described a number of species from north India. These are Angularella swifti (1952), Anoncotaenia gaugi (1952), Aporina percnopteri (1952), Choanotaenia hypoleucia (1952), Cotugnia davali (1952), Dilepis ardeolae (1952), Diorchis tilori (1952), Echinocotyle glaerolae (1952), Echinocotyle hypoleuci (1952), Echinocotyle minutissima (1952), Haploparoxis tandani (1952), Hymenolepis ababili (1952), Hymenolepis gaugi (1952), Hymenolepis magna (1952), Lapwingia reticulosa (1952), Neoangularia ababili (1952), Neoliga diplacantha (1952), Notopentorchis micropus (1952), Paricterotaenia milvi (1952), Progynotaenia longicirrata (1952), Ivritaenia mukteswarensis (1962), Ophryocotyleides mukundi (1962), Ophryocotyloides picuri (1962), Anoncotaenia indica (1964), Biuterina coracii (1964), Biuterina dicruri (1964), Choanotaenia picusi (1964), Choanotaenia tandani (1964), Ophryocotyle indicus (1964), Panuwa stylicirrosa (1964). Apart from the new species mentioned above he redescribed a number of old

species as well. His new genera include Ivritaenia, Lapiwingia, Neoangularia and Neoliga.

Singh, K.P. described Echinorhynchotaenia lucknowensis (1956), Chaenotaenia aurantia (1958), Diorchis gigantocirrosa (1959), Anomotaenia oligorhyncha (1960), Biuterina meggitti (1960) and Progynotaenia leucura (1960).

Johri, G.N. described Infula indica (1959), Dilepis balacea (1960), Hymenolepis ciconia (1960), Hymenolepis graeca (1960), Hymenolepis tankpuria (1960), Neoligorchis alternatus (1960). He erected a new genus Neoligorchis from the avian host.

Srivastava, V.C. has described Killigrewia allahabadi (Syn. Columbia allahabadi, 1965 with Capoor), Amoebotaenia gallusiana (1979), Raillietina (Paroniella) capoori (1980 with Sawada), Echinocotyle singhi (1980 with Pande), Rhabdometra agrawali (1984 with Pande), Staphylepis madrasiensis (1984 with Pande), Krimi sinhai (1984 with Tiwari) and Nadejdolepis umashankeri (1987 with Srivastava).

Capoor described a number of cestode species from north India. His important contributions from avian hosts are Taufikia ghoshi (1966), Mogheia bayamegaparuterina (1967). Capoor and Srivastava, V.C. described following new species, viz., Hymenocoelia chauhani (1964), Mogheia megaparuterina (1966), Barbusa passeri (1975), Valipora

sultanpurensis (1975 with Chauhan). They erected two new genera Barbusa and Hymenocoelia.

Shinde described a number of known and unknown cestodes from Maharashtra. His important contributions are Sureshia affinis (1968), Sureshia alii (1968), two species of Cotugnia (1969), Mediangularia swifti (1969), Davainea indica (1969), one species of Amoebotaenia (1972), Lapwingia malabarica (1972), Lapwingia singhi (1972), Lapwingia yogeshwarii (1972) and Neyraia moghei (1972). He erected a new genus Madiangularia. Shinde and Ghare described a new species of Davainea (1977).

Gupta and Grewal described Raillietina (R.) buckleyi (1969), Raillietina (R.) streptopeliae (1969), Raillietina (R.) inda (1970), Cotugnia meggitti (1971), Ophryocotyloides corvorum (1971), Ophryocotyloides sharmai (1971), Gupta and Madhu described Raillietina (R.) rybickae (1981) and Raillietina (Paroniella) delhiensis (1982).

Malvia and Dutt studied the morphology and life histories of some cestodes. Their important contributions are those of a new species of Cotugnia (1969), Raillietina (R.) mehrai (1971), Raillietina (R.) singhi (1971) and Raillietina (R.) torquata (1971).

Pandey, K.C. (1973) studied and described some species of cestodes from birds. He described in collaboration with Tayal Choanotaenia murti (1979) and two new species

of Staphylepis (1981). He in collaboration with Chaudhary described Neyraia meerutensis (1982), Lapwingia singhi (1984), Lapwingia sureshi (1984), Panuwa chauhani (1984) and Panuwa roriensis (1984) and in collaboration with Rajvanshi described Sobolevicanthus meerutensis (1983).

Srivastav , A.K. described a number of species from birds. His important contributions are Neyraia sultanpurensis (1980), Dicranotaenia alcippina (1980 with Capoor), Valipora amethiensis (1981 with Capoor), Ophryocotylus dinepii (1982 with Capoor), Cotugnia rihandensis (1984 with Capoor), Cotugnia parakeetus (1985 with Capoor). They erected a new genus Ophryocotylus from avian host. Srivastava, B.K. and Srivastav , A.K. described Amoebotaenia capoori (1987), Neyraia dayali (1988), Raillietina (P.) talourensis (1988), Raillietina (P.) amethiensis and Raillietina (P.) methensis (1988 with Dhirendra) and Doublesetina fotedari (1989). They erected a new genus Doublesetina (1989) from avian host.

Gupta, S.P. and Sinha, N. described Mogheia copsychi (1982), Mogheia orioli (1982), Angularella corvunensis (1985), Lateriporus dicruri (1985) and Neoangularia micropusi (1985).

Besides the major contributions of the aforesaid workers a number of stray papers have been published by Fuhrmann (1905, 1908, 1909 and 1912); Linstow (1906);

Smith, Fox and White (1909); Johnston (1911); Baczynska (1914); Joyeux (1928 with Houdemer); Subramanian (1928); Woodland (1929); Patwardhan (1935); Mudaliar (1943); Chatterji (1954); Mukherjee (1964, 1965 and 1970); Ali and Shinde (1966); Dhawan and Capoor (1972); Chishti (1973, 1980); Chishti (1982 with Khan); Chishti (1986 with Mir and Rasool); Fotedar (1974, 1977); Fotedar (1973 with Chishti); Bilqees (1974 with Sultana); Nama (1978); Nama (1975 with Khichi); Ghosh (1975); Baugh and Saxena (1975, 1976); Kalyankar and Palladwar (1977); Matta and Ahluwalia (1977); Wason and Johnson (1977); Saxena (1978 with Baugh); Ghare and Shinde (1980); Dixit and Capoor (1981); Grewal and Kaur (1981); Jadhav and Shinde (1981); Kishore and Sinha (1982); Srivastava et al. (1983); Kolluri, Vijaya Lakshmi and Rao (1984, 1985); Malhotra and Capoor (1979, 1985); Dixit and Capoor (1986); Bhalya and Capoor (1987a and 1987b) and Sharma and Mathur (1987).

From Indian subcontinent studies on the cestode bird host relationships are very scanty. Some of the significant contributions are those of Hegde et al. (1973); Saxena and Nama (1976), Gogoi and Chaudhuri (1982); Malhotra and Capoor (1982); Pandey (1983); Bhalya, Seth and Capoor (1984); Fotedar and Khateeb (1986); Srivastava (1987). Some allied significant references which deal with the studies related to nematode and trematodes and those

dealing with fishes, amphibia, reptiles and mammalian hosts are those of Malhotra, Chauhan and Capoor (1980); Dixit and Capoor (1980); Malhotra, Chauhan and Capoor (1981); Malhotra, Capoor, Bhalya and Seth (1982); Malhotra (1983) and Malhotra and Capoor (1984).

MATERIAL AND METHODS

The alimentary canal of the host was removed and cut open in normal saline water in troughs or petri dishes. It was lightly shaken and the contents decanted several times. The intestine and its contents containing parasites were examined thoroughly under a binocular microscope to ensure that none of the parasites is left behind. In some cases, as the scolices were deeply embedded, it was found necessary to take them out by scraping the mucosa of the intestine with a sharp scalpel or by releasing the scolices with a pair of needles. Later, portion of the mucosa attached to the cestode body was removed by shaking the body of the cestode in the normal saline water. The worms were stretched in lukeworm water and in case of larger worms, by lifting them with the help of needles or forceps against the edges of petri dishes repeatedly for several times and lateron fixed in 5% formaline or alcoholic Bouin's fluid. Fixed and washed worms were stored in 5% formaline till needed for study.

The whole mounts were stained in either Borax carmine or Mayer's Haemalum. The Mayer's Haemalum proved to be the best stain for cestodes. Whole mounts were either cleared in Xylol or Clove oil. For sectioning, the material was cleared in Xylol, embedded in histowax

and cut at 0.006-0.008 mm, stained with Delafield's Haematoxylin and Eosin and mounted in Canada balsam. The worms have also been studied in living conditions.

Only camera lucida drawings were made. All the measurements have been given in millimeters unless otherwise stated. Averages taken on the basis of the study of five to ten worms except in cases where still fewer worms were obtained.

During the course of study the total number of hosts thus examined was 390. The hosts examined belong to 23 species of birds.

For the study the cestode host relationship, the domestic fowl, _Gallus gallus_ (Linnaeus) was selected. The live birds were obtained through local bird catchers. A thorough study of four fowls were made in a month. This was continued for two successive years from November 1985 to October 1987.

Following process was used in the study of cestode host relationship:

a) Live birds were weighed individually.

b) The bird was anaesthetised with the help of chloroform and quickly dissected to find out the sex by locating the testes or ovary.

c) The alimentary canal of the bird was removed and weighed.

d) The alimentary canal of the bird was cut open in the normal saline solution in a petridish.

e) The three kinds of parasites viz., cestodes, nematodes and trematodes were collected and counted separately in each infection.

f) The morphological studies of the cestodes, thus obtained were performed and their diagnosis completed on the basis of the study of permanent stained slides.

A total number of 98 fowls were examined and 80 of them were found infected. Eighteen fowls were found negative for helminth infection. The total number of 2387 helminth parasites were obtained which included 2155 cestodes, 227 nematodes and 5 trematodes.

During the ecological studies Prevalence, Mean intensity and Relative density were calculated. The definitions given by Morgolis *et al.*, 1982 were followed.

1. Prevalence - Number of individuals of a host species infected with a particular parasite species ÷ number of hosts examined.

$$\text{Prevalence} = \frac{\text{Number of hosts infected}}{\text{Total number of hosts examined}}$$

2. <u>Mean intensity</u> - Total number of individuals of a particular parasite species in a sample of a host species ÷ number of infected individuals of the host species in the sample.

$$\text{Mean intensity} = \frac{\text{Total number of cestodes obtained}}{\text{Total number of hosts infected}}$$

3. <u>Relative density</u> - Total number of individuals of a particular parasite species in a sample of hosts ÷ total number of individuals of the host species.

$$\text{Relative density} = \frac{\text{Total number of cestodes obtained}}{\text{Total number of hosts examined}}$$

Prevalence, Mean intensity and Relative density of cestode parasites were calculated, monthwise, seasonwise and annual in relation to the following parameters:

a) Body weight of the host.

b) Weight of the alimentary canal of the host.

c) Sex of the host.

HOST PARASITE LIST

Hosts	Number examined	Number Infected	Cestodes obtained
Class Aves			
Acridotheres tristis	9	1	*Mayhewia chauhani* n.sp.
Alcippe poicephala	10	Nil	-
Anas platyrhynchos	6	Nil	-
Apus affinis	30	6	*Neoliga affinis* n.sp.
Aythya nyroca	3	1	*Armadoskrjabinia nyrocai* n.sp.
Bubo bubo	6	Nil	-
Bubo ibis	8	Nil	-
Columba livia	9	3	*Amoebotaenia capoori* n.sp.
			Hymenocoelia liviana n.sp.
			Raillietina (Raillietina) streptopeliae
Corvus macrorhynchos	3	1	*Raillietina (Paroniella) mothensis* n.sp.
			Raillietina (Raillietina) ceylonica
Francolinus podicerianus	25	18	*Raillietina (Raillietina) indica*
			Raillietina (Raillietina) nagpurensis
Gallus gallus	98	80	*Amoebotaenia agrawali* n.sp.
			Cotugnia intermedia
			Doublesetina fotedari n.g., n.sp.

			Raillietina (*Fuhrmannetta*) *talourensis* n.sp.
			Raillietina (*Raillietina*) *buckleyi*
Hirundo rustica	15	Nil	-
Limosa limosa	7	2	*Decacanthus bundelensis* n.sp.
			Infula limosai n.sp.
Lonchura striata	10	Nil	-
Lonchura malabarica	8	Nil	-
Passer domesticus	8	2	*Davainea hanumanthai* n.sp.
Ploceus manyar	5	Nil	-
Podiceps ruficollis	20	11	*Clelandia* (*Podicollis*) *sawadai* n.subg., n.sp.
			Dioecocestus indica n.sp.
			Proterandria jhansiensis n.g., n.sp.
Psittacula krameri	63	5	*Cotugnia davali* Singh, 1952
			Drepanidotaenia pandei n.sp.
			Killigrewia srivastavai n.sp.
Streptopelia chinensis	20	15	*Raillietina* (*Raillietina*) *johri*
			Raillietina (*Raillietina*) *streptopeliae*
Turdoides caudatus	3	1	*Anonchotaenia caudatai* n.sp.
Turdus merula	21	1	*Mayhewia levinei* Tandon and Singh, 1963
Upupa epops	3	2	*Neyraia davali* n.sp.

CLASSIFIED LIST OF THE CESTODE PARASITES DESCRIBED IN THE THESIS

CLASS		CESTODA
Subclass	-	Eucestoda Southwell, 1930
Order	-	Cyclophyllidea Ben. in Braun, 1900
Family	-	Anoplocephalidae Cholodkovsky, 1902
Subfamily	-	Anoplocephalinae Blanchard, 1891.
Genus	-	*Killigrewia* Meggitt, 1927
Species	-	*Killigrewia srivastavai* n.sp.
Subfamily	-	Linstowiinae Fuhrmann, 1907
Genus	-	*Doublesetina* n.g.
Species	-	*Doublesetina fotedari* n.sp.
Family	-	Davaineidae Fuhrmann, 1907
Subfamily	-	Davaineinae Braun, 1900
Genus	-	*Cotugnia* Diamare, 1893
Species	-	*Cotugnia davali* Singh, 1952
Genus	-	*Davainea* Blanchard, 1891
Species	-	*Davainea hanumanthai* n.sp.
Genus	-	*Raillietina* Fuhrmann, 1920
Subgenus	-	*Fuhrmannetta* Stiles *et* Orlemann, 1926
Species	-	*Raillietina* (*Fuhrmannetta*) *talourensis* n.sp.

Subgenus	-	*Paroniella* Fuhrmann, 1920
Species	-	*Raillietina* (*Paroniella*) *mothensis* n.sp.
Family	-	Dilepididae Railliet *et* Henry, 1909
Subfamily	-	Dilepidinae Fuhrmann, 1907
Genus	-	*Amoebotaenia* Cohn, 1900
Species	-	*Amoebotaenia agrawali* n.sp.
Species	-	*Amoebotaenia capoori* n.sp.
Genus	-	*Clelandia* Johnston, 1909
Subgenus	-	*Podicollis* n.subg.
Species	-	*Clelandia* (*Podicollis*) *sawadai* n.sp.
Genus	-	*Neoliga* Singh, 1952
Species	-	*Neoliga affinis* n.sp.
Subfamily	-	Paruterininae Fuhrmann, 1907
Genus	-	*Anoncotaenia* Cohn, 1900
Species	-	*Anoncotaenia caudatai* n.sp.
Genus	-	*Neyraia* Joyeux *et* David, 1934
Species	-	*Neyraia davali* n.sp.
Family	-	Hymenolepididae Railliet *et* Henry, 1909
Subfamily	-	Hymenolepidinae Perrier, 1897
Genus	-	*Armadoskrjabinia* Spassky *et* Spasskaja, 1954
Species	-	*Armadoskrjabinia nyrocai* n.sp.

Genus	-	*Decacanthus* Yamaguti, 1959
Species	-	*Decacanthus bundelensis* n.sp.
Genus	-	*Drepanidotaenia* Railliet, 1892
Species	-	*Drepanidotaenia pandei* n.sp.
Genus	-	*Mayhewia* Yamaguti, 1956
Species	-	*Mayhewia chauhani* n.sp.
Species	-	*Mayhewia levinei* Tandon and Singh, 1963
Family	-	Amabiliidae Fuhrmann, 1908
Genus	-	*Proterandria* n.g.
Species	-	*Proterandria jhansiensis* n.sp.
Family	-	Dioecocestidae Southwell, 1930
Subfamily	-	Dioecocestinae Fuhrmann, 1936
Genus	-	*Dioecocestus* Fuhrmann, 1900
Species	-	*Dioecocestus indica* n.sp.
Subfamily	-	Gyrocoeliinae Yamaguti, 1959
Genus	-	*Infula* Burt, 1939
Species	-	*Infula limosai* n.sp.
Subfamily	-	Hymenocoelinae Capoor and Srivastava, 1964
Genus	-	*Hymenocoelia* Capoor and Srivastava, 1964
Species	-	*Hymenocoelia liviana* n.sp.

PART- B

Family - Anoplocephalidae Cholodkovsky, 1902
Subfamily - Anoplocephalinae Blanchard, 1891
Genus - Killigrewia Meggitt, 1927
Species - Killigrewia srivastavai* n.sp.
(Plate 1, Figs. 1-4)

Out of twenty one parrots, Psittacula krameri (Scopoli) examined at Jhansi, two were found infected with four cestodes in their intestines. The morphological studies of the cestodes revealed them to belong to the genus Killigrewia Meggitt, 1927 of the subfamily Anoplocephalinae Blanchard, 1891; family Anoplocephalidae Cholodkovsky, 1902.

Cestodes measure 70-125 in length and 3.82 in maximum width. Strobila consists of acraspedote proglottids, all broader than long.

Scolex measures 0.104-0.221 x 0.161-0.239 (0.186 x 0.188), not well demarcated from the neck. Suckers four, unarmed, oval to round, measure 0.066-0.106 x 0.066-0.106 (0.081 x 0.081). Rostellum absent.

Neck prominent, measures 0.784-0.823 x 0.176-0.333 (0.803 x 0.267). Immature proglottids measure

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0.019-0.133 x 0.19-2.28 (0.071 x 1.25); mature proglottids 0.452-0.746 x 2.483-3.332 (0.545 x 2.98) and gravid proglottids 0.603-1.215 x 3.01-3.82 (1.025 x 3.55).

Testes oval to round, 84-158 (112) in number, divided in two groups by the female genitalia. Poral group shows 39-76 testes while the aporal group with 45-82 testes. Testes measure 0.029-0.068 x 0.029-0.068 (0.044 x 0.039), do not extend laterally beyond the ventral longitudinal excretory canal. Cirrus pouch measures 0.137-0.255 x 0.029-0.088 (0.193 x 0.056), crosses the poral ventral longitudinal excretory canal. Internal and external seminal vesicles absent.

Female genitalia situated in the middle or slightly towards the poral side in each proglottid. Ovary fan shaped measures 0.109-0.39 x 0.215-0.559 (0.246 x 0.375). Vitelline gland oval to spherical, postovarian, measures 0.129-0.245 x 0.139-0.255 (0.165 x 0.184). Mehlis gland measures 0.058-0.137 x 0.058-0.09 (0.102 x 0.075). Vagina measures 0.015-0.052 (0.036) in diameter. Receptaculum seminis measures 0.048-0.156 x 0.029-0.088 (0.092 x 0.045), situated at the proximal end of the vagina.

Genital atrium 0.02-0.078 (0.05) deep and 0.029-0.078 (0.054) wide. Vagina opens posterior to the

male gonopore in the genital atrium. Genital openings alternate irregularly, situated in the anterior half of the proglottid margin.

Uterus persistent, sac like with numerous outgrowths towards anterior and posterior sides, extending within the limits of ventral longitudinal excretory canals. Uterus measures 0.04-1.02 x 2.02-3.51 (0.85 x 3.01). Eggs measure 0.009-0.016 x 0.009-0.016 (0.013 x 0.013). Onchospheres measure 0.003-0.009 x 0.003-0.009 (0.006 x 0.006).

Ventral longitudinal excretory canals measure 0.02-0.05 (0.035) in diameter.

DISCUSSION

The present form comes closer to Killigrewia allahabadi (Srivastava and Capoor, 1965), Capoor and Srivastava, 1965; Killigrewia delafondi Railliet, 1892; Killigrewia fuhrmanni Skrjabin, 1914; Killigrewia indica Johri, 1962; Killigrewia jeodhii Sharma, 1943 and Killigrewia streptopeliae Yamaguti, 1935.

The present form differs from Killigrewia allahabadi (Srivastava and Capoor, 1965) in having different extension of cirrus pouch, absence of internal and external seminal vesicles and narrower receptaculum seminis. From Killigrewia delafondi Railliet, 1892 it differs in having

different extension of cirrus pouch, absence of internal and external seminal vesicles, smaller ovary and smaller eggs. From Killigrewia fuhrmanni Skrjabin, 1914 it differs in having smaller scolex, smaller number of testes, larger cirrus pouch, narrower ovary, smaller vitelline gland, smaller receptaculum seminis and smaller eggs. From Killigrewia indica Johri, 1962 it differs in having smaller scolex, smaller suckers, larger number of testes, smaller cirrus pouch, narrower ovary, smaller vitelline gland and smaller receptaculum seminis. From Killigrewia jeodhii Sharma, 1943 it differs in having smaller cirrus pouch crossing the ventral longitudinal excretory canal, presence of receptaculum seminis and smaller eggs. From Killigrewia streptopeliae Yamaguti, 1935 it differs in having different extension of cirrus pouch, absence of internal and external seminal vesicles and smaller eggs (refer Table 1).

In the light of the above discussion the present form is accommodated as a new species, Killigrewia srivastavai n.sp.

The new species is named in honour of an eminent Indian Parasitologist, Dr. C.B. Srivastava, Zoological Survey of India, Calcutta.

Host	-	_Psittacula krameri_ (Scopoli)
Habitat	-	Intestine
Locality	-	Jhansi
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Table 1

Comparison of the characters of the species closer to *Killigrewia srivastavai* n.sp.

	K. allahabadi Srivastava and Capoor, 1966	*K. delafondi* Railliet, 1892	*K. fuhrmanni* Skrjabin, 1914	*K. indica* Johri, 1962	*K. loodhii* Sharma, 1943	*K. strepto-peliae* Yamaguti, 1935	*K.* n.sp
	0.118 x 0.117	0.2-0.22	0.27	0.64	-	0.2	0.1 0.1
s	0.098 Dia	0.075-0.09	0.10	0.5-0.7	-	0.075	0.0 0.0
ber	75-120	70-120	160-200	82-86	91-100	70-120	84
s	0.029	-	0.05-0.06	-	-	-	0. 0.
pouch gth	0.147-0.221	0.18-0.25	0.05	0.32-0.58	0.32-0.58	0.2-0.25	0.
ension in ation to al ventral gitudinal retory canal	Not upto	Upto or not	-	Upto	Upto	Upto or not upto	We
l vesicle							
ernal	0.073-0.110 x 0.029-0.044	0.33 x 0.18	-	Absent	Absent	0.35 x 0.18	Al

Table 1

arison of the characters of the species closer to <u>Killigrewia</u> <u>srivastavai</u> n

<u>allahabadi</u> ivastava and poor, 1965	<u>K. delafondi</u> Railliet, 1892	<u>K.fuhrmanni</u> Skrjabin, 1914	<u>K. indica</u> Johri, 1962	<u>K. lodhii</u> Sharma, 1943	<u>K. s</u> <u>pelio</u> Yama 1935
.118 x 0.117	0.2-0.22	0.27	0.64	-	0.2
.088 Dia	0.075-0.09	0.10	0.6-0.7	-	0.07
-120	70-120	160-200	82-86	91-100	70-1
.029	-	0.05-0.06	-	-	-
.147-0.221	0.18-0.25	0.05	0.32-0.58	0.32-0.58	0.2-
t upto	Upto or not	-	Upto	Upto	Upto not
.073-0.118 x .029-0.044	0.33 x 0.18	-	Absent	Absent	0.3
.075-0.135 x .03-0.075	0.06 x 0.11	-	Absent	Absent	0.0
.324-1.003	1.1-1.23	0.85-0.90	1.1	-	0.1
.147-0.265	0.11-0.2 x 0.2-0.30	0.34	0.43	-	0.2
.147-0.398 x .088-0.265	0.12-0.25	1.445	0.40-0.55	Absent	0.1
.014	0.022-0.042	0.026	0.015-0.018	0.029	0.0

Table 1

Comparison of the characters of the species closer to *Killigrewia srivastavai* n.sp.

	K. allahabadi Srivastava and Capoor, 1965	*K. delafondi* Railliet, 1892	*K. fuhrmanni* Skrjabin, 1914	*K. indica* Johri, 1962	*K. jodhii* Sharma, 1943	*K. streptopeliae* Yamaguti, 1935	*K. srivastavai* n.sp.
Scolex	0.118 x 0.117	0.2-0.22	0.27	0.64	-	0.2	0.104-0.221 x 0.161-0.239
Suckers	0.088 Dia	0.075-0.09	0.10	0.6-0.7	-	0.075	0.066-0.106 x 0.066-0.106
Testes							
Number	75-120	70-120	160-200	82-86	91-100	70-120	84-158
Size	0.029	-	0.05-0.06	-	-	-	0.029-0.068 x 0.029-0.068
Cirrus pouch							
Length	0.147-0.221	0.18-0.25	0.05	0.32-0.58	0.32-0.58	0.2-0.25	0.137-0.255
Extension in relation to poral ventral longitudinal excretory canal	Not upto	Upto or not	-	Upto	Upto	Upto or not upto	Well past
Seminal vesicle							
Internal	0.073-0.110 x 0.029-0.044	0.33 x 0.18	-	Absent	Absent	0.35 x 0.18	Absent
External	0.075-0.135 x 0.03-0.075	0.06 x 0.11	-	Absent	Absent	0.06-0.11	Absent
Ovary width	0.324-1.003	1.1-1.25	0.85-0.90	1.1	-	0.13 x 0.24	0.215-0.559
Vitelline gland	0.147-0.255	0.11-0.2 x 0.2-0.30	0.34	0.43	-	0.22-0.3	0.129-0.245 x 0.139-0.255
Receptaculum seminis	0.147-0.398 x 0.088-0.265	0.12-0.25	1.445	0.40-0.55	Absent	0.12-0.25	0.048-0.156 x 0.029-0.088
Eggs	0.014	0.022-0.042	0.026	0.015-0.018	0.029	0.022-0.033	0.009-0.016 x 0.009-0.016

Key to the various species of the genus
Killigrewia Meggitt, 1927

1.	Receptaculum seminis absent	...	*K. leodhii*
	Receptaculum seminis present	...	2
2.	Prostate gland present	...	*K. frivola*
	Prostate gland absent	...	3
3.	Scolex width more than 0.8	...	*K. pamelae*
	Scolex width less than 0.8	...	4
4.	Sucker diameter 0.6-0.7	...	*K. indica*
	Sucker diameter less than 0.2	...	5
5.	Cirrus pouch length 0.05	...	*K. fuhrmanni*
	Cirrus pouch length more than 0.1	...	6
6.	Testes number 50	...	*K. oenopopeliae*
	Testes number 70-160	...	7
7.	Egg diameter below 0.019	...	8
	Egg diameter more than 0.02	...	9
8.	Cirrus pouch not reaching up to poral ventral longitudinal excretory canal	...	*K. allahabadi*
	Cirrus pouch crossing the poral ventral longitudinal excretory canal	...	*K. srivastavai* n.sp.
9.	Neck absent, ovary width 0.24	...	*K. streptopeliae*
	Neck present, ovary width 1.1-1.25	...	*K. delafondi*

Family - Anoplocephalidae Cholodkovsky, 1902

Subfamily - Linstowiinae Fuhrmann, 1907

Genus - Doublesetina n.g.

Species - Doublesetina fotedari* n.sp.

(Plate 2, Figs. 1-4)

One out of ninety eight birds, Gallus gallus (Linnaeus) examined at Jhansi, harboured four cestodes in its intestine. The morphological studies of the cestodes revealed them to belong to a new genus, Doublesetina n.g. and a new species Doublesetina fotedari n.sp. of the subfamily Linstowiinae Fuhrmann, 1907; family Anoplocephalidae Cholodkovsky, 1902.

Amended diagnosis of the subfamily Linstowiinae

Anoplocephalidae: Single set or double set of genitalia per proglottid. Uterus breaking down into egg capsules, each containing single egg.

Doublesetina n.g.

Generic diagnosis: Medium sized. Double set of reproductive organs. Proglottids craspedote. Testes numerous, occupying median intervascular field and never extending beyond the ventral longitudinal excretory canals. Cirrus pouch oval, elongated or club shaped. Ovaries unlobed.

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Vitelline gland postovarian. Egg single in each egg capsule, scattered throughout the gravid proglottids. Parasites of birds.

<u>Doublesetina fotedari</u> n.sp.

Cestodes measure 45-68 in length and 2.554 in maximum width. Proglottids broader than long.

Scolex measures 0.588-0.884 x 0.882-1.919 (0.713 x 1.012). Suckers four, unarmed, oval to round measure 0.202-0.519 x 0.201-0.521 (0.421 x 0.398). Rostellum absent.

Neck absent. Proglottids craspedote. Immature proglottids measure 0.058-0.137 x 0.798-1.215 (0.082 x 1.021); mature proglottids 0.256-0.412 x 1.032-2.156 (0.351 x 1.982) and gravid proglottids 0.204-0.588 x 1.568-2.554 (0.421 x 1.881).

Genitalia double per proglottids. Testes oval to round, 30-60 (45) in number, occupying median intervascular field and posterolateral to female genitalia. Testes measure 0.026-0.068 x 0.016-0.068 (0.052 x 0.053), not extending beyond the ventral longitudinal excretory canals. Cirrus pouch oval, elongated or club shaped, extending beyond the poral ventral longitudinal excretory canals.

Cirrus pouch measures 0.136-0.274 x 0.029-0.088 (0.212 x 0.042). Internal and external seminal vesicles absent.

Ovaries two, compact and unlobed measure 0.038-0.095 x 0.112-0.234 (0.083 x 0.154). Vitelline gland compact, postovarian, measures 0.019-0.058 x 0.048-0.118 (0.039 x 0.092). Vagina, 0.006-0.026 (0.009) in diameter, opens posterior to cirrus pouch in the genital atrium. Receptaculum seminis measures 0.028-0.117 x 0.022-0.098 (0.082 x 0.061), situated at the proximal end of vagina.

Genital atrium, 0.02-0.058 (0.039) in depth and 0.022-0.069 (0.032) in width. Genital openings bilateral, situated in the anterior half of the proglottid margin.

Uterus breaks down into egg capsules. Egg capsules measure 0.031-0.068 x 0.032-0.068 (0.052 x 0.052), scattered throughout the gravid proglottids, extending even beyond the ventral longitudinal excretory canals. Each egg capsule contains single egg. Eggs measure 0.02-0.049 x 0.022-0.049 (0.033 x 0.033). Onchospheres, 0.011-0.029 x 0.011-0.029 (0.019 x 0.019).

Ventral longitudinal excretory canals measure 0.013-0.032 (0.025) in diameter.

DISCUSSION

Yamaguti, 1959 included following genera in the subfamily Linstowiinae Fuhrmann, 1907 viz., Multicapsiferina Fuhrmann, 1921 and Sobolevina Spassky, 1951 from birds and Atriotaenia Sandground, 1926; Cycloskrjabinia Spassky, 1951; Linstowia Zschokke, 1899; Mathevotaenia Akhumian, 1946; Ochmarenia Spassky, 1951 from mammals.

The present form differs from all the reported genera in having double set of genitalia.

In the light of the above discussion the present form is accommodated as a new genus and a new species, Doublesetina fotedari n.g., n.sp.

The species is named after Prof. (Dr.) D.N. Fotedar, an eminent Indian Helminthologist.

Host	–	Gallus gallus (Linnaeus)
Habitat	–	Intestine
Locality	–	Jhansi (U.P.)
Holotype	–	Department of Zoology, Bipin Behari College, Jhansi

Key to the various genera of the subfamily, Linstowiinae Fuhrmann, 1907

1.	Parasites of birds	...	2
	Parasites of mammals	...	4
2.	Single set of genitalia per proglottid	...	3
	Double set of genitalia per proglottid	...	<u>Doublesetina</u> n.g.
3.	Female gonads between dorsal and ventral excretory stems of pore side	...	<u>Multicapsiferina</u>
	Female gonads medial to ventral excretory stems	...	<u>Sobolevina</u>
4.	Testes separated into two (an anterior and a posterior) groups cirrus pouch spherical	...	<u>Cycloskrjabinia</u>
	Testes not separated into two (an anterior and posterior) groups	...	5
5.	Genital pores unilateral	...	<u>Oschmarenia</u>
	Genital pores alternating irregularly	...	6
6.	Genital ducts passing ventral to excretory stem	...	<u>Linstowia</u>
	Genital ducts passing between or dorsal to excretory stems	...	7

7. Genital ducts opening from behind into genital atrium, which sometimes form a sucker like muscular organ ... Atriotaenia

Genital ducts opening as usual into genital atrium, which does not form a distinct sucker like organ ... Mathevotaenia

Family - Davaineidae Fuhrmann, 1907

Subfamily - Davaineinae Braun, 1900

Genus - Cotugnia Diamare, 1893

Species - Cotugnia davali Singh, 1952

(Plate 3, Figs. 1-5)

One out of twenty one parrots, Psittacula krameri (Scopoli) examined at Jhansi, was found infected with five cestodes. Cestodes were present in the intestine of the host. Morphological studies of the cestodes revealed them to belong to the species Cotugnia davali Singh, 1952 of the subfamily Davaineinae Braun, 1900; family Davaineidae Fuhrmann, 1907.

Cestodes measure 30-60 (40) in length and 3.244 in maximum width as seen in the gravid proglottids. The strobila consists of a number of proglottids, all broader than long and craspedote.

Scolex measures 0.234-0.352 x 0.231-0.529 (0.301 x 0.412). Suckers four, unarmed, oval to spherical measure 0.088-0.166 x 0.088-0.196 (0.131 x 0.131). Rostellum broader than long, measures 0.052-0.147 x 0.204-0.352 (0.098 x 0.312). Rostellar hooks 200-290 (250) in number, arranged in two alternate rows. Rostellar hooks measure 0.006-0.015 (0.009) in length.

Neck prominent, measures 0.294-0.588 x 0.156-0.294 (0.412 x 0.198). Immature proglottids measure 0.029-0.251 x 0.313-1.176 (0.162 x 0.982); mature proglottids 0.292-0.744 x 1.272-2.273 (0.521 x 1.982) and gravid proglottids 0.842-1.974 x 1.764-3.244 (0.992 x 2.102).

Genitalia double per proglottid. Testes 62-136 (80) in number, round, distributed in one group, extended laterally beyond the ventral longitudinal excretory canals on each side. Testes measure 0.013-0.058 x 0.013-0.058 (0.039 x 0.039). Cirrus pouch clubshaped measures 0.176-0.374 x 0.029-0.079 (0.215 x 0.052), extends upto or crosses the ventral longitudinal excretory canal of its side. Vas deferens coiled before entering into the cirrus pouch. Internal and external seminal vesicles absent.

Ovaries two, one on either side, situated near the respective ventral longitudinal excretory canal. Ovaries unlobed measure 0.058-0.176 x 0.082-0.296 (0.099 x 0.192). Vitelline gland measures 0.048-0.112 x 0.058-0.176 (0.091 x 0.098), posteromedial to each ovary. Vagina measures 0.01-0.031 (0.021) in diameter. Vagina opens posterior to the cirrus pouch in the genital atrium. Receptaculum seminis measures 0.049-0.189 x 0.029-0.107 (0.091 x 0.068), situated at the proximal end of the vagina.

Genital atrium, 0.069-0.168 (0.098) deep and 0.092-0.208 (0.158) wide. Genital openings bilateral, located in the anterior half of the proglottid margin.

Uterus replaced by egg capsules which get scattered throughout the gravid proglottid, extending even beyond the ventral longitudinal excretory canals. Egg capsules measure 0.038-0.057 x 0.038-0.057 (0.045 x 0.045). Each egg capsule contains a single egg. Eggs measure 0.019-0.046 x 0.019-0.046 (0.032 x 0.032). Onchospheres measure 0.014-0.024 x 0.014-0.026 (0.02 x 0.02).

Ventral longitudinal excretory canals measure 0.025-0.059 (0.035) in diameter.

DISCUSSION

A comparison of the present form with all the reported species of the genus _Cotugnia_ Diamare, 1893 reveals its closeness to _Cotugnia dayali_ Singh, 1952 (refer Table 2). The only major difference between the two lies in number of rostellar hooks and number and size of testes, which alone do not warrant the erection of a new species for the present form. The present study reveals its wider geographical distribution as it has been reported from Lucknow only.

It is thus concluded that the number of rostellar hooks in the *Cotugnia dayali* Singh, 1952 be considered as 200-290 and their length from 0.006-0.015. The number of testes be considered as 35-136 and their size from 0.013-0.075. The extension of cirrus pouch be considered as upto or crossing the poral ventral longitudinal excretory canal. The diameter of egg and onchosphere be considered as 0.019-0.056 and 0.014-0.03 respectively.

Host - *Psittacula krameri* (Scopoli)

Habitat - Intestine

Locality - Jhansi (U.P.)

Holotype - Department of Zoology,
Bipin Behari College, Jhansi

Table 2

Comparison of the characters of <u>Cotugnia dayali</u> Singh, 1952 with the present form

	<u>Cotugnia dayali</u> Singh, 1952	<u>Cotugnia dayali</u> (Present form)
Size	79 x 3.27	30-60 x 3.244
Scolex	0.32 x 0.45	0.234-0.352 x 0.231-0.529
Suckers	0.194 (dia.)	0.088-0.196 (dia.)
Rostellum	0.13 x 0.08	0.052-0.147 x 0.204-0.352
Rostellar hooks		
Number	200	200-290
Size	0.012-0.014	0.006-0.015
Testes		
Number	55-70	62-136
Size	0.065-0.075	0.013-0.058 x 0.013-0.058
Cirrus pouch		
Size	0.28 x 0.043	0.176-0.374 x 0.029-0.079
Extension in relation to ventral longitudinal excretory canal	upto	upto or crosses
Ovary width	0.28-0.3	0.082-0.296
Vitelline gland	0.14 x 0.17	0.048-0.112 x 0.058-0.176
Receptaculum seminis	0.245	0.049-0.189 x 0.029-0.107
Eggs	0.054-0.056	0.019-0.046 x 0.019-0.046
Onchosphere	0.03	0.014-0.024 x 0.014-0.026

Family - Davaineidae Fuhrmann, 1907

Subfamily - Davaineinae Braun, 1900

Genus - Davainea Blanchard, 1891

Species - Davainea hanumanthai n.sp.

(Plate 4, Figs. 1-5)

Out of the eight house sparrows, Passer domesticus (Linnaeus) examined at Jhansi (U.P.) two were found infected with twelve cestodes. The cestodes were present in the intestine of the host. The morphological studies of the cestodes revealed them to belong to the genus Davainea Blanchard, 1891; subfamily Davaineinae Braun, 1900 and family Davaineidae Fuhrmann, 1907.

Cestodes small, measure 15-20 (18) in length and 1.078 in maximum width as seen in the gravid proglottids. Strobila consists of 40-50 (45) craspedote proglottids. Immature and mature proglottids broader than long while gravid proglottids longer than broad.

Scolex measures 0.302-0.431 x 0.203-0.452 (0.361 x 0.395). Suckers four, round, unarmed, measure 0.05-0.086 x 0.05-0.085 (0.073 x 0.071). Rostellum prominent measures 0.07-0.139 x 0.166-0.27 (0.099 x 0.201). Rostellar hooks number 120-140 (130), hammer shaped, arranged in two rows. Rostellar hooks of anterior row measure 0.007-0.017 (0.009) and those of the posterior row measure 0.004-0.015 (0.008) in length.

Neck absent. Immature proglottids measure 0.058-0.196 x 0.272-0.471 (0.081 x 0.39); mature proglottids 0.288-0.688 x 0.784-1.176 (0.468 x 0.981) and gravid proglottids 0.589-1.136 x 0.509-1.078 (0.992 x 0.983).

Testes number 14-22 (18), oval to round, postovarian in two groups. Poral group contains 8-12 and aporal group 6-10 testes. Testes measure 0.029-0.062 x 0.029-0.062 (0.049 x 0.045). Cirrus pouch 0.105-0.239 x 0.035-0.101 (0.201 x 0.081), reaches upto the poral ventral longitudinal excretory canal. Internal and external seminal vesicles absent. Vas deferens coiled.

Female genitalia medial. Ovary bilobed, slightly poral, measures 0.032-0.134 x 0.117-0.278 (0.097 x 0.192). Vitelline gland postovarian, compact measures 0.029-0.054 x 0.053-0.098 (0.038 x 0.068). Vagina, 0.008-0.017 (0.012) in diameter, opens posterior to the cirrus pouch into the genital atrium. Receptaculum seminis measures 0.039-0.088 x 0.038-0.058 (0.068 x 0.042).

Genital atrium 0.01-0.029 (0.021) deep and 0.021-0.068 (0.054) wide. Genital pores marginal, irregularly alternating, situated in the anterior half of the proglottid margin.

Uterus replaced by egg capsules. Egg capsules scattered within the limits of ventral longitudinal excretory canals. Each egg capsule contains single egg. Egg capsules measure 0.021-0.058 x 0.02-0.058 (0.031 x 0.031). Eggs measure 0.011-0.04 x 0.011-0.04 (0.025 x 0.025). Onchospheres measure 0.01-0.015 x 0.007-0.015 (0.012 x 0.012). Embryonic hooks, 0.003-0.009 (0.006) in length.

Ventral longitudinal excretory canals measure 0.015-0.032 (0.021) in diameter. Dorsal longitudinal excretory canals measure 0.011-0.035 (0.028) in diameter.

DISCUSSION

The present form comes closer to *Davainea indica* Shinde, 1969 and *Davainea meleagridis* Jones, 1936.

From *Davainea indica* Shinde, 1969 it differs in having longer worms, fewer and smaller rostellar hooks, greater number of proglottids, wider testes and longer cirrus pouch. From *Davainea meleagridis* Jones, 1936 it differs in having longer worms, greater number of proglottids, fewer testes and in the absence of regularly alternating genital pores (refer Table 3).

In view of the aforesaid distinguishing features it is proposed to accommodate the present form as a new species, *Davainea hanumanthai* n.sp.

The species is named after the eminent Indian Helminthologist, Dr. K. Hanumantha Rao, former Professor and Head of Zoology Department, Waltair University, Waltair (A.P.), India.

Host - Passer domesticus (Linnaeus)

Habitat - Intestine

Locality - Jhansi (U.P.)

Holotype - Department of Zoology,
Bipin Behari College, Jhansi

Table 3

Comparison of the characters of species closer to Davainea hanumanthai n.sp.

	Davainea indica Shinde, 1969	Davainea meleagridis Jones, 1936	Davainea hanumanthai n.sp.
Size	4.07–4.31	5.0	15–20 x 1.078
Rostellar hooks			
Number	150–160	100–133	120–140
Size	0.03	-	0.007–0.017
Proglottid number	35–38	17–22	40–50
Testes			
Number	20–24	22–36	14–22
Size	0.03	-	0.029–0.062 x 0.029–0.062
Cirrus pouch			
Size	0.18	-	0.105–0.239 x 0.035–0.101
Ovary	0.04–0.18	-	0.032–0.134 x 0.117–0.278
Vitelline gland	0.03–0.075	-	0.029–0.054 x 0.053–0.098
Genital pore	Irregularly alternate	Both regularly and irregularly alternate	Irregularly alternate

Family - Davaineidae Fuhrmann, 1907

Subfamily - Davaineinae Braun, 1900

Genus - Raillietina Fuhrmann, 1920

Subgenus - Fuhrmannetta Stiles et Orlemann, 1926

Species - Raillietina (Fuhrmannetta) talourensis* n.sp.

(Plate 5, Figs. 1-5)

One out of ninety eight domestic fowls, Gallus gallus (Linnaeus) harboured nine cestodes in its intestine. Morphological studies of the cestodes revealed them to belong to the subgenus Fuhrmannetta Stiles et Orlemann, 1926 of the genus Raillietina Fuhrmann, 1920, subfamily Davaineinae Braun, 1900 and family Davaineidae Fuhrmann, 1907.

Cestodes measure 7-35 (20) in length and 1.332 in maximum width as seen in the gravid proglottids. Proglottids broader than long and craspedote.

Scolex measures 0.302-0.531 x 0.305-0.529 (0.414 x 0.405). Suckers four, unarmed, oval to spherical, measure 0.06-0.152 x 0.06-0.153 (0.11 x 0.12). Rostellum broader than long, measures 0.107-0.16 x 0.233-0.382 (0.14 x 0.35). Rostellar hooks 220-240 (230) in number, arranged in two

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alternate rows. Rosteller hooks measure 0.006-0.022 (0.014) in length.

Neck prominent, measures 0.156-0.196 x 0.254-0.372 (0.176 x 0.327). Immature proglottids measure 0.035-0.176 x 0.254-0.744 (0.095 x 0.46); mature proglottids 0.176-0.413 x 0.66-0.98 (0.241 x 0.812) and gravid proglottids 0.49-0.784 x 0.901-1.332 (0.63 x 1.01).

Testes 11-18 (14) in number, oval to spherical and distributed posterolateral to female genitalia within the limits of ventral longitudinal excretory canals. Testes measure 0.024-0.061 x 0.024-0.061 (0.049 x 0.049). Vas deferens much coiled measure 0.009-0.012 (0.01) in diameter. Cirrus pouch oval to club shaped, measures 0.144-0.281 x 0.036-0.083 (0.189 x 0.069), reaches upto the poral ventral longitudinal excretory canal. Internal and external seminal vesicles absent.

Female genitalia situated in the middle of the proglottid or slightly aporal. Ovary bilobed, measures 0.042-0.098 x 0.166-0.231 (0.083 x 0.206). Vitelline gland compact, postovarian, measures 0.03-0.064 x 0.056-0.109 (0.05 x 0.078). Vagina measures 0.011-0.018 (0.015) in diameter. Vagina opens posterior to the cirrus pouch in the genital atrium. Receptaculum seminis measures 0.068-0.148 x 0.02-0.043 (0.098 x 0.032), situated at the

proximal end of vagina. Ootype measures 0.019-0.044 x 0.012-0.044 (0.028 x 0.028).

Genital atrium 0.015-0.053 (0.04) deep and 0.016-0.044 (0.038) wide. Genital openings irregularly alternating located in the anterior half of the proglottid margin.

Uterus replaced by egg capsules. Egg capsules measure 0.056-0.144 x 0.038-0.142 (0.099 x 0.099). In the gravid proglottids each egg capsule contains 3-11 eggs. Eggs measure 0.015-0.025 x 0.015-0.025 (0.02 x 0.02). Onchospheres measure 0.004-0.017 x 0.004-0.017 (0.009 x 0.009).

Ventral longitudinal excretory canal measure 0.015-0.04 (0.03) in diameter. Transverse excretory canals measure 0.016-0.04 (0.022) in diameter.

DISCUSSION

The present form comes to *Raillietina* (*Fuhrmannetta*) *birmanica* Meggitt, 1926; *Raillietina* (*Fuhrmannetta*) *echinobothrida* Megnin, 1880 and *Raillietina* (*Fuhrmannetta*) *nepalis* Sharma, 1943.

The present form differs from *Raillietina* (*Fuhrmannetta*) *birmanica* Meggitt, 1926 in having longer worms, fewer rostellar hooks, fewer testes and different

extension of cirrus pouch in relation to poral ventral longitudinal excretory canal. From Raillietina (Fuhrmannetta) echinobothrida Megnin, 1880 it differs in having smaller worms, more of rosteller hooks, fewer testes, different extension of cirrus pouch in relation to poral ventral longitudinal excretory canal and larger egg capsules. From Raillietina (Fuhrmannetta) nepalis Sharma, 1943 it differs in having smaller worms, wider scolex, wider suckers, larger rostellum and larger number of rostellar hooks (refer Table 4).

In the light of the above discussion the present form is accommodated as a new species, Raillietina (Fuhrmannetta) talourensis n.sp.

Host	-	Gallus gallus (Linnaeus)
Habitat	-	Intestine
Locality	-	Taloure, Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Table 4

Comparison of the characters of the species closer to Raillietina (Fuhrmannetta) talourensis n.sp.

	R.(F.) birmanica Meggitt, 1926	R.(F.) echinobothrida Megnin, 1880	R.(F.) nepalis Sharma, 1943	R.(F.) talourensis n.sp.
Size	8-10 x 1-2	250 x 4	160-180 x 0.7	7-35 x 1.332
Scolex	-	-	0.16	0.305-0.329
Suckers	-	-	0.026	0.06-0.152 x 0.05-0.153
Rostellum	-	-	0.036	0.107-0.16 x 0.233-0.382
Rostellar hooks				
Number	300	200	28-36	220-240
Length	0.09-0.12	0.1-0.13	0.012	0.006-0.022
Testes				
Number	20-25	20-30	14-18	11-18
Cirrus pouch				
Size	-	0.13-0.18	0.215 x 0.038	0.144-0.281 x 0.035-0.083
Extension in relation to poral ventral longitudinal excretory canal	Well past	Not reaching	-	Reaches upto
Egg capsule	-	0.025-0.05	-	0.056-0.144 x 0.058-0.142

Family - Davaineidae Fuhrmann, 1907

Subfamily - Davaineinae Braun, 1900

Genus - Raillietina Fuhrmann, 1920

Subgenus - Paroniella Fuhrmann, 1920

Species - Raillietina (Paroniella) mothensis* n.sp.

(Plate 6, Figs. 1-5)

One out of three jungle crows, Corvus macrorhynchos (Wagler) examined at Moth, District Jhansi, was found infected with four cestodes. Morphological studies of the cestodes revealed them to belong to the subgenus Paroniella Fuhrmann, 1920 of the genus Raillietina Fuhrmann, 1920; subfamily Davaineinae Braun, 1900 and family Davaineidae Fuhrmann, 1907.

Cestodes measure 38-112 in length and 2.251 in maximum width as seen in the gravid proglottids. Strobila with numerous proglottids. Proglottids broader than long and craspedote.

Scolex distinctly demarcated from the neck. Scolex measures 0.176-0.295 x 0.196-0.294 (0.192 x 0.212). Suckers four, oval to round, measure 0.088-0.197 x 0.088-0.137 (0.099 x 0.098). Suckers armed with 4-6 rows of sucker spines. Sucker spines measure 0.003-0.015 (0.009) in length. Rostellum disc shaped, measures 0.058-0.098 x

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* Published in J. Zool. Res. 1(2): 95-100, 1988.

0.074-0.157 (0.072 x 0.093). Rostellum provided with 160-280 (230) rostellar hooks, arranged in two alternating rows. Rostellar hooks of both the rows measure 0.016-0.023 (0.02) in length.

Neck prominent, measures 1.568-2.156 x 0.156-0.255 (1.892 x 0.198). Immature proglottids measure 0.039-0.117 x 0.254-0.686 (0.065 x 0.426); mature proglottids 0.137-0.295 x 0.823-1.554 (0.192 x 0.992) and gravid proglottids 0.372-0.321 x 1.372-2.551 (0.412 x 1.522).

Testes 18-30 in number, oval to round, encircling the vitelline gland. Testes measure 0.016-0.041 x 0.017-0.044 (0.032 x 0.032), do not extend laterally beyond the ventral longitudinal excretory canals. Cirrus pouch club shaped, measures 0.078-0.147 x 0.02-0.058 (0.102 x 0.042), does not reach upto the poral ventral longitudinal excretory canal. Internal and external seminal vesicles absent.

Female genitalia located obliquely towards the poral side. Ovary follicular, measures 0.047-0.094 x 0.078-0.196 (0.062 x 0.093). Vitelline gland compact, postovarian, measures 0.029-0.078 x 0.079-0.127 (0.043 x 0.098). Vagina measures 0.004-0.022 (0.011) in diameter, opens posterior to cirrus pouch in the genital atrium. Receptaculum seminis measures 0.058-0.111 x 0.033-0.068 (0.082 x 0.05), situated at the proximal end of vagina.

Genital atrium 0.012-0.025 (0.02) deep and 0.012-0.023 (0.02) wide. Genital openings unilateral, located in the anterior half of the proglottid margin.

Uterus breaks down into egg capsules which extend beyond the ventral longitudinal excretory canal in gravid proglottids. Egg capsules measure 0.03-0.066 x 0.03-0.066 (0.042 x 0.049). Each egg capsule contains single egg. Eggs measure 0.029-0.043 x 0.029-0.043 (0.038 x 0.038). Onchospheres measure 0.01-0.025 x 0.016-0.025 (0.019 x 0.02).

Ventral longitudinal excretory canals measure 0.016-0.056 (0.041) in diameter.

DISCUSSION

The present form comes closer to *Raillietina* (*Paroniella*) *bulbularum* Tubangui *et* Masilungan, 1937; *Raillietina* (*Paroniella*) *cruciata* Rudolphi, 1819; *Raillietina* (*Paroniella*) *duosyntesticulata* Moghe *et* Inamdar, 1934; *Raillietina* (*Paroniella*) *macassarensis* Yamaguti, 1956 and *Raillietina* (*Paroniella*) *myzomelae* Yamaguti, 1956.

The present form differs from *Raillietina* (*Paroniella*) *bulbularum* Tubangui *et* Masilugan, 1937 in having wider worms, narrower scolex, fewer rows of sucker spines and smaller testes. From *Raillietina* (*Paroniella*)

crucicata Rudolphi, 1819 it differs in having larger worms, narrower scolex, larger rostellar hooks and larger cirrus pouch. From Raillietina (Paroniella) duosyntesticulata Moghe et Inamdar, 1934 it differs in having larger worms, smaller scolex, larger rostellar hooks, larger testes and wider ovary. From Raillietina (Paroniella) macassarensis Yamaguti, 1956 it differs in having wider worms, larger suckers, smaller sucker spines and larger rostellar hooks. From Raillietina (Paroniella) myzomelae Yamaguti, 1956 it differs in having narrower worms, narrower scolex, greater number of larger rostellar hooks, narrower testes and wider ovary (refer Table 5).

In the light of the above discussion the present form is accommodated as a new species, Raillietina (Paroniella) mothensis n.sp.

Host	-	Corvus macrorhynchos (Wagler)
Habitat	-	Intestine
Locality	-	Moth, Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Table 5

Comparison of the characters of the species closer to Raillietina (Paroniella) nothensis n.sp.

	R.(P.) bulbularum Tubangui et Masilungan, 1937	R.(P.) cruciata Rudolphi, 1819	R.(P.) duosyntesticulata Moghe et Inamdar, 1934	R.(P.) macassarensis Yamaguti, 1956	R.(P.) myzomelae Yamaguti, 1956	R.(P.) nothensis n.sp.
Size	70 x 1.5	40 x 0.8	40 x 2.1	47-72 x 1.0-1.7	50-60 x 2.6-3.9	38-112 x 2.251
Scolex	0.5	0.3-0.41	0.64 x 0.4	0.21-0.25	0.3-0.37	0.176-0.295 x 0.195-0.294
Sucker	0.11-0.13 x 0.09-0.11	0.13-0.19	0.12 x 0.14	0.095-0.1 x 0.075-0.084	0.06-0.09	0.088-0.197 x 0.088-0.137
Sucker spines						
Rows	7-8	-	5	-	-	4-6
Length	0.015-0.0153	-	-	0.05	0.01	0.003-0.015
Rostellum	0.07-0.08 x 0.015-0.17	0.126	0.114	0.075-0.09	0.09	0.058-0.098 x 0.074-0.157
Rostellar hooks						
Number	-	200	234	-	140-190	160-280
Length	0.012-0.023	0.014-0.016	0.017	0.0072-0.0084	0.017-0.018	0.016-0.023
Testes						
Number	26-30	-	32-37	20-28	29-45	18-50
Size	0.042-0.062	-	0.021	0.075-0.1	0.05-0.09	0.016-0.041 x 0.017-0.044
Cirrus pouch						
Length	0.13-0.15	0.07	0.096	0.075-0.1	0.11-0.13	0.078-0.147
Ovary	-	-	0.01 x 0.007	-	0.032-0.036	0.047-0.094 x 0.078-0.196

Family - Dilepididae Railliet *et* Henry, 1909

Subfamily - Dilepidinae Fuhrmann, 1907

Genus - *Amoebotaenia* Cohn, 1900

Species - *Amoebotaenia agrawali* n.sp.

(Plate 7, Figs. 1-5)

Two out of ninety eight domestic fowls, *Gallus gallus* (Linnaeus) examined at Jhansi were found infected with fifty cestodes of the present form. Cestodes were obtained from the small intestine of the host. The morphological studies of the cestodes revealed them to belong to the genus *Amoebotaenia* Cohn, 1900 of the subfamily Dilepidinae Fuhrmann, 1907; family Dilepididae Railliet *et* Henry, 1909.

Cestodes measure 1.568-1.86 (1.652) in length and 1.372 in maximum width as seen in the gravid proglottids. Strobila consists of 18-21 proglottids, all broader than long and craspedote.

Scolex measures 0.196-0.295 x 0.196-0.304 (0.225 x 0.262), not much demarcated from the strobila. Suckers four, oval to sperical, unarmed, measure 0.078-0.137 x 0.068-0.137 (0.098 x 0.098). Rostellum protrusible, measures 0.117-0.157 x 0.039-0.108 (0.132 x 0.062). Rostellar hooks 12-14 in number, arranged in a single row. Rostellar hooks measure 0.048-0.065 (0.052) in length.

Each rostellar hook contains a handle measuring 0.02-0.027 (0.021); a guard 0.012-0.018 (0.016) and a blade 0.025-0.033 (0.028) in length.

Neck absent. Immature proglottids measure 0.019-0.039 x 0.27-0.313 (0.025 x 0.291); mature proglottids 0.039-0.127 x 0.45-0.882 (0.072 x 0.682) and gravid proglottids 0.078-0.236 x 0.882-1.372 (0.132 x 1.021).

Testes number 14-22, oval to round, arranged in two groups in a transverse row in the posterior half of the proglottid. Poral group contains 6-10 while the aporal group 8-12 testes. Testes measure 0.019-0.039 x 0.019-0.039 (0.028 x 0.028). Cirrus pouch elongated, measures 0.05-0.098 x 0.015-0.035 (0.072 x 0.023), crosses the poral ventral longitudinal excretory canal. Internal seminal vesicle measures 0.035-0.058 x 0.01-0.02 (0.045 x 0.015). External seminal vesicle absent.

Female genitalia slightly towards the poral side. Ovary transversely extended, measures 0.005-0.023 x 0.079-0.147 (0.015 x 0.112). Vitelline gland postovarian, compact, unlobed, measures 0.014-0.026 x 0.014-0.029 (0.02 x 0.02). Vagina measures 0.005-0.01 (0.008) in diameter. Receptaculum seminis measures 0.025-0.049 x 0.014-0.029 (0.031 x 0.019), situated at the proximal end of the vagina.

Genital atrium 0.005-0.014 (0.009) deep and 0.021-0.034 (0.028) wide. Genital openings alternate regularly, located in the anterior half of the proglottid margin. Vagina opens posterior to male gonopore in the genital atrium.

Uterus sac like, extends within the limits of ventral longitudinal excretory canals. Uterus measures 0.082-0.187 x 0.853-1.101 (0.095 x 0.982). Eggs measure 0.02-0.034 x 0.02-0.034 (0.03 x 0.03). Onchospheres measure 0.014-0.021 x 0.014-0.021 (0.019 x 0.019).

Ventral longitudinal excretory canals measure 0.004-0.018 (0.009) in diameter.

DISCUSSION

The present form comes closer to *Amoebotaenia indica* Srivastava *et al.*, 1983; *Amoebotaenia madrasiensis* Dixit and Capoor, 1981 and *Amoebotaenia spinosa* Yamaguti, 1956.

The present form differs from *Amoebotaenia indica* Srivastava *et al.*, 1983 in having smaller worms, larger suckers, more of larger rostellar hooks, more of smaller testes distributed in two groups, smaller and wider cirrus pouch which crosses the poral ventral longitudinal excretory canal, absence of external seminal

vesicle and smaller vitelline gland. From *Amoebotaenia madrasiensis* Dixit and Capoor, 1981 it differs in having longer rostellum, larger rostellar hooks, presence of internal seminal vesicle, shorter ovary and smaller vitelline gland. From *Amoebotaenia spinosa* Yamaguti, 1956 it differs in having longer worms, more of larger rostellar hooks, more of testes and smaller cirrus pouch which crosses the poral ventral longitudinal excretory canal (refer Table 6).

In the light of the above discussion the present form is accommodated as a new species *Amoebotaenia agrawali* n.sp.

The new species is named in honour of an eminent Parasitologist, Dr. G.P. Agrawal, Prof. and Head, Zoology Department, Banaras Hindu University, Varanasi.

Host	-	*Gallus gallus* (L.)
Habitat	-	Small intestine
Locality	-	Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Family - Dilepididae Railliet *et* Henry, 1909
Subfamily - Dilepidinae Fuhrmann, 1907
Genus - *Amoebotaenia* Cohn, 1900
Species - *Amoebotaenia capoori** n.sp.
(Plate 8, Figs. 1-5)

Two out of four pigeons, *Columba livia* (Gmelin) examined at Jhansi were found infected with fifteen cestodes in their intestines. The morphological studies of the cestodes revealed them to belong to the genus *Amoebotaenia* Cohn, 1900; subfamily Dilepidinae Fuhrmann, 1907; family Dilepididae Railliet *et* Henry, 1909.

Cestodes small measure 1.8-2.2 in length and 1.273 in maximum width as seen in the gravid proglottids. Strobila consists of 15-17 proglottids, all broader than long and craspedote.

Scolex not distinctly demarcated from the strobila. Scolex measures 0.152-0.215 x 0.15-0.248 (0.184 x 0.223). Suckers four, spherical, unarmed, measure 0.064-0.133 x 0.065-0.104 (0.101 x 0.095). Rostellum protrusible, measures 0.107-0.178 x 0.06-0.101 (0.112 x 0.081). Rostellar hooks 10-12, arranged in a circle, measure 0.021-0.048 (0.031) in length. Each rostellar hook contains a long handle, 0.015-0.025 (0.02); a short guard, 0.006-0.013

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(0.009) and a long blade, 0.014-0.021 (0.019) in length.

Neck absent. Immature proglottids measure 0.019-0.047 x 0.255-0.342 (0.033 x 0.307); mature proglottids 0.076-0.133 x 0.342-0.76 (0.106 x 0.589) and gravid proglottids 0.228-0.289 x 0.722-1.273 (0.256 x 0.971).

Testes number 11-17 (14), oval to round, post-ovarian, arranged in two groups, one on each side of the vitelline gland in the posterior half of the proglottid. Poral group contains 5-7, while aporal group 6-10 testes. Testes measure 0.02-0.054 x 0.022-0.052 (0.035 x 0.032), extend laterally within the limits of ventral longitudinal excretory canals. Cirrus pouch oval, measures 0.078-0.117 x 0.029-0.058 (0.094 x 0.042), crosses the poral ventral longitudinal excretory canal. Vas deferens measures 0.003-0.01 (0.009) in diameter. Internal and external seminal vesicles absent.

Female genitalia medial. Ovary bilobed, transversely extended, measures 0.012-0.053 x 0.163-0.53 (0.033 x 0.213), remains within the limits of ventral longitudinal excretory canals. Vitelline gland post-ovarian, compact, measures 0.021-0.035 x 0.057-0.086 (0.029 x 0.07). Vagina measures 0.006-0.03 (0.02) in diameter. Receptaculum seminis measures 0.012-0.035 x 0.01-0.028 (0.027 x 0.021).

Genital atrium 0.01-0.023 (0.019) deep and 0.01-0.029 (0.02) wide. Genital pores alternating regularly, situated in the anterior one third of the proglottid margin. Vagina opens anterior to the male gonopore in the genital atrium.

Uterus measures 0.168-0.251 x 0.72-1.021 (0.201 x 0.982), sac like, extends even beyond the limits of ventral longitudinal excretory canals. Eggs measure 0.012-0.035 x 0.015-0.032 (0.018 x 0.018). Onchospheres measure 0.009-0.029 x 0.009-0.029 (0.016 x 0.016).

Ventral longitudinal excretory canals measure 0.01-0.025 (0.02) in diameter.

DISCUSSION

The present form closer to *Amoebotaenia cuneata* Linstow, 1872; *Amoebotaenia fuhrmanni* Tseng, 1932; *Amoebotaenia gallusiana* Srivastava, 1979; *Amoebotaenia indica* Srivastava *et al*., 1983; *Amoebotaenia longisacculus* Yamaguti, 1956 and *Amoebotaenia sphenoides* Railliet, 1892.

The present form differs from *Amoebotaenia cuneata* Linstow, 1872 in having shorter strobila, fewer proglottids, wider rostellum, fewer larger rostellar hooks and smaller cirrus pouch. From *Amoebotaenia fuhrmanni* Tseng, 1932 it differs in having fewer proglottids, wider rostellum,

smaller rostellar hooks, wider testes and longer cirrus pouch. From <u>Amoebotaenia gallusiana</u> Srivastava, 1979 it differs in having wider worms, fewer proglottids, narrower scolex, smaller suckers, larger rostellum, more testes which remain within the limits of the ventral longitudinal excretory canals, wider cirrus pouch, different lateral extension of ovary, unlobed vitelline gland, presence of receptaculum seminis and smaller genital atrium. From <u>Amoebotaenia indica</u> Srivastava <u>et al</u>., 1983 it differs in having wider worms, larger suckers, testes distributed in two groups which do not extend laterally beyond the ventral longitudinal excretory canals, wider cirrus pouch which extends beyond the poral ventral longitudinal excretory canal, absence of internal and external seminal vesicles, larger ovary and larger vitelline gland. From <u>Amoebotaenia longisacculus</u> Yamaguti, 1956 it differs in having narrower scolex, narrower rostellum, more of rostellar hooks, smaller testes and smaller cirrus pouch. From <u>Amoebotaenia sphenoides</u> Railliet, 1892 it differs in having wider rostellum, fewer and larger rostellar hooks and uterus which never shows finger like out growths (refer Table 7).

In the light of the above discussion the present form is accommodated as a new species, <u>Amoebotaenia capoori</u> n.sp.

The species is named in honour of Dr. V.N. Capoor, Parasitologist, Reader, Department of Zoology, University of Allahabad, Allahabad.

Host	-	*Columba livia* (Gmelin)
Habitat	-	Intestine
Locality	-	Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Table 8

Comparison of the characters of the new species of the genus Amoebotaenia Cohn, 1900 described in the thesis

	A. agrawali n.sp.	A. capoori n.sp.
Host	Gallus gallus (L.)	Columba livia (G.)
Size	1.568-1.86 x 1.372	1.8-2.2 x 1.273
Scolex	0.196-0.295 x 0.196-0.304	0.152-0.215 x 0.15-0.248
Rostellum	0.117-0.157 x 0.039-0.108	0.107-0.178 x 0.06-0.101
Rostellar hook		
Number	12-14	10-12
Length	0.045-0.065	0.021-0.048
Proglottid number	18-21	15-17
Testes		
Number	14-22	11-17
Size	0.019-0.039 x 0.019-0.039	0.02-0.054 x 0.022-0.052
Cirrus pouch	0.05-0.098 x 0.015-0.035	0.078-0.117 x 0.029-0.058
Internal seminal vesicle	Present	Absent
Vagina	Opens posterior to cirrus pouch in genital atrium	Opens anterior to cirrus pouch in genital atrium
Receptaculum seminis	0.025-0.049 x 0.014-0.029	0.012-0.035 x 0.01-0.028
Uterus	Within the limits of ventral longitudinal excretory canal	Extends beyond the limits of ventral longitudinal excretory canal

Family - Dilepididae Railliet *et* Henry, 1909

Subfamily - Dilepidinae Fuhrmann, 1907

Genus - *Clelandia* Johnston, 1909

Subgenus - *Podicollis* n. subg.

Species - *Clelandia* (*Podicollis*) *sawadai* n.sp.
(Plate 9, Figs. 1-5)

Two out of four little grebes, *Podiceps ruficollis* (Pallas) examined at Baruwasagar, Distt. Jhansi (U.P.) harboured eight cestodes of the present form in their intestines. Morphological studies of the cestodes revealed them to belong to the new subgenus *Podicollis* n.subg., genus *Clelandia* Johnston, 1909; subfamily Dilepidinae Fuhrmann, 1907; family Dilepididae Railliet *et* Henry, 1909.

Amended diagnosis of the genus *Clelandia* Johnston, 1909

Dilepidinae: With a single crown of rostellar hooks. Proglottids craspedote. Testes not numerous encircling female glands. Genital ducts dorsal to excretory stems. Cirrus pouch large, anterior, overreaching median line; cirrus spined. Genital pores unilateral or alternating. Ovary two winged, median; with vitelline gland behind. Uterus sac like. Parasites of birds.

Clelandia (Podicollis) sawadai n.subg., n.sp.

Cestodes measure 1.966-3.548 in length and 0.648 in maximum width as seen in the gravid proglottids. Proglottids extremely craspedote, broader than long.

Scolex measures 0.101-0.298 x 0.204-0.372 (0.201 x 0.281), well demarcated from the neck. Suckers unarmed, oval to round, measure 0.088-0.161 x 0.089-0.169 (0.112 x 0.121). Rostellum protruded, cylindrical, measures 0.254-0.301 x 0.025-0.098 (0.331 x 0.051). Rosteller hooks 10-12 in number, arranged in a single row. Rosteller hooks measure 0.021-0.033 (0.026) in length. Each rosteller hook bears a short handle 0.002-0.012 (0.006), a guard 0.006-0.018 (0.011) and a blade 0.012-0.024 (0.019) in length.

Neck measures 0.06-0.137 x 0.106-0.235 (0.101 x 0.201). Immature proglottids measure 0.029-0.098 x 0.165-0.232 (0.059 x 0.201); mature proglottids 0.098-0.198 x 0.2-0.491 (0.123 x 0.352) and gravid proglottids 0.121-0.235 x 0.231-0.648 (0.204 x 0.481).

Testes 4-7 in number, oval to sperical, encircling the female genitalia. Testes measure 0.012-0.037 x 0.012-0.039 (0.025 x 0.028). Cirrus pouch oval, measures 0.078-0.199 x 0.021-0.068 (0.099 x 0.045), reaches upto or crosses the middle of the proglottid width. Cirrus

prominent and spined. Internal and external seminal vesicles absent.

Female genitalia median. Ovary slightly bilobed, obliquely disposed measures 0.011-0.038 x 0.071-0.106 (0.022 x 0.099). Vitelline gland compact, postovarian, measures 0.011-0.022 x 0.015-0.038 (0.018 x 0.021). Vagina, 0.004-0.009 (0.006) in diameter, opens posterior to the cirrus pouch in the genital atrium. Receptaculum seminis measures 0.011-0.045 x 0.009-0.025 (0.035 x 0.011), located at the proximal end of the vagina.

Genital atrium, 0.006-0.02 (0.011) in depth and 0.01-0.025 (0.018) in width. Genital pores alternating regularly located in the anterior half of the proglottid margin.

Uterus persistent, sac like, measures 0.07-0.199 x 0.112-0.212 (0.125 x 0.183), within the limits of ventral longitudinal excretory canals. Uterus filled with numerous eggs. Eggs measure 0.009-0.019 x 0.009-0.023 (0.012 x 0.013). Onchospheres measure 0.006-0.01 x 0.006-0.01 (0.008 x 0.008).

Ventral longitudinal excretory canals measure 0.006-0.019 (0.009) in diameter.

DISCUSSION

So far only one species of the genus, Clelandia parva Johnston, 1909 has been reported. It shows the presence of unilateral genital pores.

The present form characteristically shows the presence of regularly alternating genital pores. Hence it is proposed to devide the genus into two new subgenera and to accommodate it as a new subgenus and a new species, Clelandia (Podicollis n.subg.) sawadai n.sp.

The name of species is designated after eminent Cestodologist, Dr. Isamu Sawada of Japan.

Host	-	Podiceps ruficollis (Pallas)
Habitat	-	Intestine
Locality	-	Baruwasagar, Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Key to the subgenera of the genus <u>Clelandia</u> Johnston, 1909

Genital pores unilateral	...	*Clelandia* n.subg.
Genital pores alternating regularly	...	*Podicollis* n.subg.

Family - Dilepididae Railliet et Henry, 1909

Subfamily - Dilepidinae Fuhrmann, 1907

Genus - Neoliga Singh, 1952

Species - *Neoliga affinis* n.sp.

(Plate 10, Figs. 1-5)

Six out of thirty house swifts, *Apus affinis* (Grey) examined at Jhansi, harboured twenty five cestodes. The cestodes were present in the duodenum of the host. Morphological studies of the cestodes revealed them to belong to the genus *Neoliga* Singh, 1952 of the subfamily *Dilepidinae* Fuhrmann, 1907; family Dilepididae Railliet *et* Henry, 1909.

Cestodes measure 5-7.8 (6.0) in length and 0.982 in maximum width as seen in the gravid proglottids. Proglottids broader than long and craspedote.

Scolex measures 0.301-0.403 x 0.299-0.362 (0.361 x 0.313). Suckers four unarmed, oval, measure 0.176-0.253 x 0.098-0.151 (0.212 x 0.112). Rostellum protrusible, measures 0.196-0.361 x 0.078-0.161 (0.211 x 0.099). Rostellum provided with 26 rostellar hooks, arranged in two alternating rows. Rostellar hooks of anterior row measure 0.027-0.074 (0.061) and those of posterior row 0.02-0.062 (0.051) in length. Rostellar hooks of anterior row possess a handle, 0.019-0.032 (0.026); a guard, 0.001-

0.005 (0.003) and a blade, 0.003-0.019 (0.008) in length. Rosteller hooks of posterior row possess a handle, 0.015-0.028 (0.021), a guard, 0.001-0.004 (0.002) and a blade, 0.002-0.008 (0.004) in length.

Neck absent. Immature proglottids measure 0.019-0.098 x 0.261-0.431 (0.061 x 0.321); mature proglottids 0.156-0.509 x 0.512-0.853 (0.351 x 0.713) and gravid proglottids 0.429-0.599 x 0.625-0.982 (0.501 x 0.785). Anterior proglottids without spines.

Testes 16-26 (21) in number, oval to round and arranged posterolateral to female genitalia within the limits of ventral longitudinal excretory canals. Testes measure 0.019-0.068 x 0.019-0.068 (0.052 x 0.052). Cirrus pouch elongated, measures 0.402-0.695 x 0.02-0.073 (0.586 x 0.061), extends obliquely anteriorwards upto threefourth of proglottid width. Internal and external seminal vesicles absent.

Female genitalia median. Ovary bilobed measures 0.025-0.215 x 0.431-0.553 (0.182 x 0.492), each lobe subdivided in digitate processes. Vitelline gland postovarian, lobulated measures 0.048-0.098 x 0.047-0.117 (0.062 x 0.093). Vagina measures 0.02-0.079 (0.042) in diameter, constricts nearly in the middle forming a sphincter. Vagina opens anterior to cirrus pouch in the genital atrium. Receptaculum seminis measures 0.156-0.246 x 0.048-0.088 (0.188 x 0.066).

Genital atrium prominent, crosses the ventral longitudinal excretory canal of its side. Genital atrium 0.098-0.192 (0.151) deep and 0.078-0.126 (0.101) wide. Genital openings regularly alternating, situated in the anterior half of the proglottid margin.

Uterus persistent, sac like measures 0.358-0.492 x 0.382-0.582 (0.421 x 0.471), filled with numerous eggs. Eggs measure 0.012-0.019 x 0.011-0.019 (0.016 x 0.016). Onchospheres measure 0.007-0.014 x 0.007-0.014 (0.009 x 0.009).

Ventral longitudinal excretory canals measure 0.02-0.056 (0.04) in diameter.

DISCUSSION

The present form comes closer to Neoliga diplacantha Singh, 1952 and Neoliga singhi Shinde, Jadhav and Kadam, 1981.

The present form differs from Neoliga diplacantha Singh, 1952 in having larger worms, absence of neck, unspined anterior proglottids, greater number of testes and larger cirrus pouch. From Neoliga singhi Shinde, Jadhav and Kadam, 1981 in having larger scolex, larger suckers, larger rostellum, greater number of rostellar hooks, absence of neck, unspined anterior

proglottids, smaller testes and larger cirrus pouch (refer Table 9).

In the light of the above discussion the present form is accommodated as a new species, Neoliga affinis n.sp.

Host	-	Apus affinis (Grey)
Habitat	-	Duodenum
Locality	-	Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Table 9

Comparison of the characters of the species closer to *Neoliga affinis* n.sp.

	N. diplacantha Singh, 1952	*N. singhi* Shinde, Jadhav and Kadam, 1981	*N. affinis* n.sp.
Size	5.5-5.6 x 0.598	-	5-7.8 x 0.982
Scolex	0.333 x 0.304	0.171 x 0.168	0.301-0.403 x 0.299-0.362
Suckers	0.194 x 0.159	0.079 x 0.066	0.176-0.253 x 0.098-0.151
Rostellum	0.24 x 0.13	0.151 x 0.007	0.196-0.361 x 0.078-0.161
Rostellar hooks			
Number	26	24	26
Rows	2	-	2
Size			
Anterior hooks	0.052	0.065	0.027-0.074
Posterior hooks	0.065	0.047	0.02-0.062
Neck	Present	Present	Absent
Spines on neck and anterior proglottids	Present	Present	Absent
Testes			
Number	20	20	16-26
Size	0.056-0.065	0.181-0.191	0.019-0.068
Cirrus pouch			
Size	0.285-0.465	0.135 x 0.027	0.402-0.695 x 0.02-0.073

Family - Dilepididae Railliet et Henry, 1909

Subfamily - Paruterininae Fuhrmann, 1907

Genus - Anoncotaenia Cohn, 1900

Species - Anoncotaenia caudatai n.sp.

(Plate 11, Figs. 1-3)

One out of three common babbler, Turdoides caudatus (Dumont) examined at Jhansi, was found infected with five cestodes in its intestine. Morphological studies of the cestodes revealed them to belong to the genus Anoncotaenia Cohn, 1900; subfamily Paruterininae Fuhrmann, 1907 and family Dilepididae Railliet et Henry, 1909.

Cestodes measure 42-52 (48) in length and 0.961 in maximum width as seen in gravid proglottids. Strobila consists of several proglottids, all broader than long.

Scolex not clearly demarcated from the neck. Scolex measures 0.392-0.588 x 0.507-0.842 (0.421 x 0.741). Suckers four unarmed, oval to round, measure 0.151-0.333 x 0.215-0.333 (0.295 x 0.295). Rostellum absent.

Neck prominent, measures 0.502-0.952 x 0.501-0.653 (0.763 x 0.582). Immature and mature proglottids acraspedote while gravid proglottids craspedote. Immature proglottids measure 0.019-0.039 x 0.431-0.582 (0.024 x 0.495); mature proglottids 0.051-0.167 x 0.506-0.725

(0.085 x 0.612) and gravid proglottids 0.117-0.245 x 0.588-0.961 (0.192 x 0.781).

Testes 8-10 in number, oval to round, in two lateral fields within the limits of ventral longitudinal excretory canal. Aporal group consists of 5-8 and poral 2-4 testes. Testes measure 0.02-0.068 x 0.02-0.068 (0.042 x 0.042). Cirrus pouch club shaped, measures 0.129-0.305 x 0.012-0.058 (0.202 x 0.032), well past the poral ventral longitudinal excretory canal. Internal and external seminal vesicles absent.

Ovary lobed, slightly poral, measures 0.012-0.058 x 0.033-0.088 (0.041 x 0.056). Vitelline gland compact measures 0.008-0.023 x 0.012-0.033 (0.012 x 0.022). Vagina measures 0.006-0.018 (0.009) in diameter. Vagina opens posterior to cirrus pouch in the genital atrium. Receptaculum seminis measures 0.011-0.033 x 0.012-0.033 (0.021 x 0.022), situated at the proximal end of vagina.

Genital atrium, 0.006-0.02 (0.012) deep and 0.007-0.025 (0.012) wide. Genital openings alternate irregularly, situated in the anterior half of the proglottid margin.

Uterus sac like measures 0.074-0.186 x 0.074-0.156 (0.12 x 0.12). Paruterine organ develops laterally

as an oval to conical structure but later becomes spherical. Paruterine organ measures 0.13-0.201 x 0.221-0.301 (0.181 x 0.262). Eggs measure 0.01-0.019 x 0.01-0.019 (0.015 x 0.014). Onchospheres measure 0.004-0.01 x 0.004-0.015 (0.008 x 0.008).

Ventral longitudinal excretory canals measure 0.02-0.033 (0.024) in diameter.

DISCUSSION

The present form comes closer to *Anoncotaenia brasiliensis* Fuhrmann, 1908; *Anoncotaenia dendrocitta* Woodland, 1929; *Anoncotaenia longiovata* (Fuhrmann, 1901) Fuhrmann, 1908; *Anoncotaenia macrocephala* Fuhrmann, 1908; *Anoncotaenia quiscali* Rausch *et* Morgan, 1947 and *Anoncotaenia yadavi* Sharma and Mathur, 1987.

The present form differs from *Anoncotaenia brasiliensis* Fuhrmann, 1908 in having wider scolex, more of testes and larger cirrus pouch. From *Anoncotaenia dendrocitta* Woodland, 1929 it differs in having smaller number of testes, larger cirrus pouch and lobed ovary. From *Anoncotaenia longiovata* (Fuhrmann, 1901) Fuhrmann, 1908 it differs in having smaller worms, wider scolex, longer cirrus pouch and smaller eggs. From *Anoncotaenia macrocephala* Fuhrmann, 1908 it differs in having smaller worms, fewer testes and longer cirrus pouch. From

Anoncotaenia quiscali Rausch *et* Morgan, 1947 it differs in having smaller worms, wider scolex, longer cirrus pouch and paruterine organ which appears on lateral side. From *Anoncotaenia yadavi* Sharma and Mathur, 1987 it differs in having wider suckers, different extension of cirrus pouch, different disposition of ovary and presence of receptaculum seminis (refer Table 10).

In the light of the above discussion it is proposed to accommodate the present form as a new species, *Anoncotaenia caudatai* n.sp.

Host	-	*Turdoides caudatus* (Dumont)
Habitat	-	Intestine
Locality	-	Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Key to the Indian species of the genus *Anoncotaenia* Cohn, 1900

1.	Testes number upto 9	...	2
	Testes number more than 9	...	*A. gaugi*
2.	Cirrus pouch not crosses the poral ventral longitudinal excretory canal	...	3
	Cirrus pouch crosses the poral ventral longitudinal excretory canal	...	*A. caudatai* n.sp.
3.	Suckers diameter 0.12-0.19	...	*A. yadavi*
	Suckers diameter 0.312-0.401	...	*A. indica*

Family - Dilepididae Railliet et Henry, 1909

Subfamily - Paruterininae Fuhrmann, 1907

Genus - Neyraia Joyeux et David, 1934

Species - Neyraia davali* n.sp.

(Plate 12, Figs. 1-5)

Out of three hoopoe birds, Upupa epops (Linnaeus) examined at Jhansi, two were found infected with eleven cestodes of present form in their intestine. Morphological studies of the cestodes revealed them to belong to the genus Neyraia Joyeux et David, 1934 of the subfamily Paruterininae Fuhrmann, 1907; family Dilepididae Railliet et Henry, 1909.

Cestodes measure 47-79 (65) in length and 0.725 in maximum width as seen in the gravid proglottids. Proglottids craspedote. Immature and mature proglottids broader than long while gravid proglottids longer than broad.

Scolex not well demarcated from the neck. Scolex measures 0.4-0.88 x 0.47-0.59 (0.62 x 0.51). Suckers four, unarmed, oval to round measure 0.156-0.235 x 0.156-0.225 (0.215 x 0.201). Rostellum eversible, measures 0.078-0.15 x 0.078-0.15 (0.099 x 0.098). Rostellar sac measures 0.049-0.098 x 0.107-0.19 (0.057 x 0.171). Rostellar hooks 74-90 (82) in number, arranged

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in four alternating rows. Hooks of first row 18-20 in number, measure 0.0038-0.017 x 0.004-0.008 (0.008 x 0.0048); hooks of second row 18-22 in number, measure 0.0051-0.021 x 0.005-0.086 (0.01 x 0.007); hooks of third row 20-24 in number, measure 0.0086-0.025 x 0.006-0.012 (0.019 x 0.009) and hooks of fourth row 22-24 in number, measure 0.02-0.041 x 0.006-0.019 (0.031 x 0.009).

Neck measures 0.823-1.274 x 0.254-0.49 (1.042 x 0.336). Immature proglottids measure 0.039-0.098 x 0.254-0.411 (0.065 x 0.331); mature proglottids 0.137-0.196 x 0.392-0.49 (0.163 x 0.446) and gravid proglottids 0.341-1.038 x 0.333-0.725 (0.951 x 0.381).

Testes oval to round, 8-14 in number, measure 0.023-0.029 x 0.025-0.038 (0.026 x 0.033), arranged posterolateral to the female genitalia, extend laterally upto the ventral longitudinal excretory canals. Cirrus pouch oval, measures 0.077-0.129 x 0.02-0.038 (0.109 x 0.026), crosses the poral ventral longitudinal excretory canal. Internal seminal vesicle measures 0.073-0.128 x 0.009-0.027 (0.094 x 0.012). External seminal vesicle measures 0.021-0.036 x 0.012-0.027 (0.028 x 0.021).

Female genitalia median. Ovary lobed, measures 0.013-0.045 x 0.086-0.157 (0.039 x 0.102). Vitelline gland postovarian, oval to round, measures 0.01-0.023 x

0.018-0.038 (0.018 x 0.034). Vagina measures 0.003-0.018 (0.009) in diameter, opens posterior to cirrus pouch in the genital atrium. Receptaculum seminis measures 0.016-0.027 x 0.01-0.018 (0.022 x 0.016), situated at the proximal end of the vagina.

Genital atrium 0.008-0.019 (0.016) deep and 0.01-0.019 (0.015) wide. Genital pore irregularly alternate, located at the anterior half of the proglottid margin.

Uterus measures 0.02-0.161 x 0.352-0.481 (0.081 x 0.401), initially a transverse sac but later on constricts into two separate sacs. Uterus filled up with many eggs. Eggs measure 0.021-0.055 x 0.021-0.058 (0.034 x 0.034). Onchospheres measure 0.01-0.039 x 0.01-0.039 (0.028 x 0.028). Embryonic hooks measure 0.013-0.034 (0.028) in length. A paruterine organ measures 0.49-0.726 x 0.2-0.47 (0.579 x 0.358), located anterior to the uterus.

Ventral longitudinal excretory canals measure 0.006-0.014 (0.009) in diameter.

DISCUSSION

The present form comes closer to *Neyraia meerutensis* Pandey and Chaudhary, 1982; *Neyraia parva* Mahon, 1958; *Neyraia sultanpurensis* Srivastav, 1980 and *Neyraia upupai* Ortlepp, 1940.

The present form differs from *Neyraia meerutensis* Pandey and Chaudhary, 1982 in having smaller worms, wider scolex, larger suckers, greater number and more rows of rostellar hooks and larger testes in single field. From *Neyraia parva* Mahon, 1958 it differs in having larger worms, wider scolex and larger suckers. From *Neyraia sultanpurensis* Srivastav, 1980 it differs in having narrower worms, larger suckers, testes distributed in single field, different extension of cirrus pouch, presence of both internal and external seminal vesicles, wider ovary and smaller vitelline gland. From *Neyraia upupai* Ortlepp, 1940 it differs in having larger worms, narrower scolex, smaller testes in single field, presence of both internal and external seminal vesicles and smaller vitelline gland (refer Table 11).

In the light of the above discussion the present form is accommodated as a new species, *Neyraia dayali* n.sp.

The species is named in honour of Dr. Har Dayal Srivastava, eminent Parasitologist of India.

Host	-	*Upupa epops* (Linnaeus)
Habitat	-	Intestine
Locality	-	Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Key to the Indian species of the genus *Neyraia* Joyeux *et* David, 1934

1.	Cirrus pouch reaching upto the poral ventral longitudinal excretory canal	...	2
	Cirrus pouch well past the poral ventral longitudinal excretory canal	...	3
2.	Rostellar hooks number 68-72	...	*N. moghei*
	Rostellar hooks number 72-78	...	*N. sultanpurensis*
3.	Testes arranged in two groups	...	*N. meerutensis*
	Testes arranged in single group	...	*N. dayali* n.sp.

Family - Hymenolepididae Railliet *et* Henry, 1909

Subfamily - Hymenolepidinae Perrier, 1897

Genus - *Armadoskrjabinia* Spassky *et* Spasskaja, 1954

Species - *Armadoskrjabinia nyrocai* n.sp.

(Plate 13, Figs. 1-5)

One out of three Kurchiya birds, *Aythya nyroca* (Guldenstadt) examined, was found infected with sixteen cestodes. Cestodes were obtained from the intestine of the host. The morphological studies of the cestodes revealed them to belong to the genus *Armadoskrjabinia* Spasky *et* Spasskaja, 1954 of the subfamily Hymenolepidinae Perrier, 1897; family Hymenolepididae Railliet *et* Henry, 1909.

Cestodes measure 70-80 (75) in length and 0.744 in maximum width as seen in the gravid proglottids. Strobila consists of broader than long and craspedote proglottids.

Scolex measures 0.203-0.392 x 0.201-0.393 (0.251 x 0.253), indistinctly demarcated from the neck. Suckers four, unarmed, oval to round, measure 0.075-0.117 x 0.075-0.118 (0.098 x 0.098). Rostellum protrusible, measures 0.123-0.233 x 0.068-0.176 (0.165 x 0.113). Rostellar hooks 10 in number, arranged in a single row. Rostellar

hooks measure 0.04-0.055 (0.049) in length. Handle and blade are approximately equal, guard being prominent but considerably shorter. Handle measures 0.013-0.022 (0.018); guard, 0.004-0.009 (0.007) and blade, 0.015-0.025 (0.02) in length.

Neck prominent, measures 0.882-1.372 x 0.137-0.355 (1.01 x 0.201). Immature proglottids measure 0.019-0.058 x 0.235-0.421 (0.036 x 0.313); mature proglottids 0.058-0.198 x 0.431-0.608 (0.092 x 0.561) and gravid proglottids 0.098-0.205 x 0.535-0.744 (0.151 x 0.612).

Testes 3, oval to round, two aporal and one poral, in a transverse row. Laterally the testes do not extend beyond the ventral longitudinal excretory canals. Testes measure 0.035-0.058 x 0.035-0.059 (0.048 x 0.048). Cirrus pouch elongated, measures 0.274-0.392 x 0.019-0.062 (0.311 x 0.042), extends beyond the middle of the proglottid width. Internal seminal vesicle measures 0.15-0.355 x 0.006-0.035 (0.201 x 0.021). External seminal vesicle measures 0.01-0.066 x 0.01-0.033 (0.037 x 0.02). Cirrus armed, measures 0.05-0.08 (0.06) in length.

Female genitalia slightly aporal. Ovary transversely extended, measures 0.006-0.022 x 0.031-0.075 (0.009 x 0.042). Vitelline gland compact, postovarian, measures 0.005-0.021 x 0.012-0.0413 (0.009 x 0.021).

Vagina measures 0.002-0.01 (0.006) in diameter. Receptaculum seminis absent.

Genital atrium 0.01-0.025 (0.021) deep and 0.01-0.02 (0.015) wide. Genital pores unilateral, located in the middle of the proglottid margin. Vagina opens posterior to cirrus pouch in the genital atrium.

Uterus measures 0.048-0.183 x 0.382-0.562 (0.158 x 0.471), initially uterus appears as a transverse tube but later on divided in two sacs, extended laterally beyond the ventral longitudinal excretory canals. Eggs measure 0.012-0.022 x 0.012-0.022 (0.018 x 0.018). Onchospheres measure 0.006-0.011 x 0.006-0.011 (0.009 x 0.009).

Ventral longitudinal excretory canals measure 0.01-0.045 (0.03) in diameter.

DISCUSSION

The present form comes closer to _Armadoskriabinia magniuncinata_ (Meggitt, 1927) Yamaguti, 1959 and _Armadoskriabinia parviuncinata_ Meggitt, 1927.

The present form differs from _Armadoskriabinia magniuncinata_ (Meggitt, 1927) Yamaguti, 1959 in having larger worms, fewer and larger rostellar hooks, different arrangement of testes, longer cirrus pouch and different

location of the genital pores. From Armadoskrjabinia parviuncinata Meggitt, 1927 it differs in having larger worms, larger rostellar hooks, larger cirrus pouch which never reaches the aporal ventral longitudinal excretory canal and in different location of the genital pore (refer Table 12).

In the light of the above discussion the present form is accommodated as a new species, Armadoskrjabinia nyrocai n.sp.

Host	-	Aythys nyroca (Guldenstadt)
Habitat	-	Intestine
Locality	-	Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Table 12

Comparison of the characters of the species closer to <u>Armadoskrjabinia</u> <u>nyrocai</u> n.sp.

	<u>A. magniuncinata</u> (Meggitt, 1927) Yamaguti, 1959	<u>A. parviuncinata</u> (Meggitt, 1927)	<u>A. nyrocai</u> n.sp.
Size	7 x 0.5	4.0 x 0.3	70-80 x 0.744
Scolex	0.16-0.29	0.15-0.3	0.203-0.392 x 0.201-0.393
Rostellum	0.15	-	0.123-0.239 x 0.068-0.176
Rostellar hooks			
Number	More than 10	10	10
Size	0.039	0.013-0.018	0.04-0.055
Testes			
Number	3	-	3
Arrangement	Arranged in a triangle	-	Arranged in a transverse row
Cirrus pouch			
Size	0.2-0.25 x 0.05-0.06	0.11-0.12 x 0.023-0.028	0.274-0.392 x 0.019-0.062
Extension in relation to aporal ventral longitudinal excretory canal	Upto	Occasionally crossing	Not reaching
Genital pore	In the anterior half of the proglottid margin	In the anterior half of the proglottid margin	In the middle of the proglottid margin

Family - Hymenolepididae Railliet et Henry, 1909

Subfamily - Hymenolepidinae Perrier, 1897

Genus - Decacanthus Yamaguti, 1959

Species - Decacanthus bundelensis* n.sp.

(Plate 14, Figs. 1-5)

Out of the three khag birds, Limosa limosa (Linnaeus) examined, one was found infected with eight cestodes of the present form. Cestodes were obtained from the intestine of the host. The morphological studies of the cestodes revealed them to belong to the genus Decacanthus Yamaguti, 1959; subfamily Hymenolepidinae Perrier, 1897 and family Hymenolepididae Railliet et Henry, 1909.

Cestodes measure 60-80 (70) in length and 1.238 in maximum width as seen in gravid proglottids. Strobila consists of many craspedote proglottids, all broader than long.

Scolex measures 0.181-0.491 x 0.198-0.482 (0.351 x 0.325), not much demarcated from the neck. Suckers four, unarmed, oval to round, measure 0.085-0.156 x 0.085-0.156 (0.108 x 0.112). Rostellum longer than broad, measures

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0.06-0.126 x 0.02-0.068 (0.09 x 0.04). Rostellum provided with 10 rostellar hooks, arranged in a single row. Rostellar hooks measure 0.006-0.011 (0.009) in length. Handle 0.002-0.006 (0.004); guard 0.002-0.005 (0.003) and blade 0.003-0.007 (0.005) in length.

Neck measures 0.392-0.482 x 0.176-0.352 (0.442 x 0.282). Immature proglottids measure 0.029-0.059 x 0.25-0.509 (0.041 x 0.42); mature proglottids 0.068-0.197 x 0.501-0.882 (0.098 x 0.712) and gravid proglottids 0.1-0.301 x 0.601-1.238 (0.225 x 0.991).

Testes 3, oval to round, arranged in a transverse row, two testes poral and one aporal. Testes measure 0.033-0.075 x 0.031-0.075 (0.051 x 0.052). Cirrus pouch measures 0.296-0.476 x 0.021-0.078 (0.351 x 0.053), surpassing middle of the proglottid width. Internal seminal vesicle measures 0.207-0.435 x 0.006-0.048 (0.351 x 0.021). External seminal vesicle measures 0.031-0.072 x 0.022-0.063 (0.041 x 0.05).

Female genitalia medial. Ovary digitate, measures 0.012-0.042 x 0.03-0.065 (0.03 x 0.051). Vitelline gland compact, postovarian, measures 0.005-0.019 x 0.01-0.041 (0.009 x 0.032). Vagina measures 0.004-0.01 (0.008) in diameter, opens posterior to cirrus pouch in the genital atrium. Receptaculum seminis voluminous, measures 0.02-0.081 x 0.012-0.023 (0.042 x 0.019).

Genital atrium 0.016-0.054 (0.025) deep and 0.015-0.04 (0.023) wide. Genital openings unilateral located in the anterior half of the proglottid margin.

Uterus initially a transverse sac extending beyond the limits of ventral longitudinal excretory canals but later on occupies the whole gravid proglottid. Uterus measures 0.04-0.205 x 0.02-1.025 (0.098 x 0.95). Eggs measure 0.019-0.04 x 0.019-0.041 (0.03 x 0.03). Onchospheres measure 0.01-0.028 x 0.01-0.028 (0.018 x 0.018).

Ventral longitudinal excretory canals measure 0.01-0.035 (0.025) in diameter.

DISCUSSION

So far only one species of the genus Decacanthus Yamaguti, 1959 has been reported viz., Decacanthus arcticus (Schiller, 1955) Yamaguti, 1959. The present form differs from Decacanthus arcticus (Schiller, 1955) Yamaguti, 1959 in having larger scolex, larger suckers, shorter rostellum, smaller rostellar hooks, smaller testes, presence of internal seminal vesicle and in different disposition of ovary (refer Table 13).

In the light of the above discussion a new species, Decacanthus bundelensis n.sp. is being established for the present form.

Host - Limosa limosa (Linnaeus)

Habitat - Intestine

Locality - Jhansi (U.P.)

Holotype - Department of Zoology,
Bipin Behari College, Jhansi

Table 13

Comparison of the characters of *Decacanthus arcticus* (Schiller, 1955) Yamaguti, 1959 and *Decacanthus bundelensis* n.sp.

	Decacanthus arcticus (Schiller, 1955) Yamaguti, 1959	*Decacanthus bundelensis* n.sp.
Size	60-80 x 2	60-80 x 1.238
Scolex	0.148 x 0.176	0.181-0.491 x 0.198-0.482
Suckers	0.048	0.085-0.156 x 0.085-0.156
Rostellum	0.136 x 0.04	0.06-0.126 x 0.02-0.068
Rostellar hooks		
Number	10	10
Size	0.015	0.006-0.011
Testes		
Size	0.198 x 0.096	0.033-0.075 x 0.031-0.075
Cirrus pouch		
Size	0.448 x 0.035	0.296-0.476 x 0.021-0.078
Internal seminal vesicle	Absent	0.207-0.435 x 0.006-0.048
Ovary disposition	Aporal	Medial

Key to the species of the genus Decacanthus
Yamaguti, 1959

1. Rostellar hooks
0.006-0.011 long,
internal seminal
vesicle present,
ovary medial ... D. bundelensis n.sp.

Rostellar hooks 0.015 long,
internal seminal vesicle
absent, ovary aporal ... D. arcticus

Family - Hymenolepididae Railliet *et* Henry, 1909

Subfamily - Hymenolepidinae Perrier, 1897

Genus - *Drepanidotaenia* Railliet, 1892

Species - *Drepanidotaenia pandei* n.sp.

(Plate 15, Figs. 1-5)

Two out of twenty one parrots, *Psittacula krameri* (Scopoli) were found infected with five cestodes of the present form. Cestodes were obtained from the intestine of the host. The morphological studies of the cestodes revealed them to belong to the genus *Drepanidotaenia* Railliet, 1892 of the subfamily Hymenolepidinae Perrier, 1897; family Hymenolepididae Railliet *et* Henry, 1909.

Cestodes measure 90-170 (130) in length and 0.35 in maximum width as seen in the gravid proglottids. Strobila consists of many craspedote and broader than long proglottids.

Scolex measures 0.204-0.313 x 0.196-0.254 (0.292 x 0.201), distinctly demarcated from the neck. Suckers four, unarmed, oval, measure 0.078-0.169 x 0.05-0.119 (0.098 x 0.085). Rostellum protrusible, measures 0.176-0.292 x 0.039-0.109 (0.201 x 0.078). Rostellar hooks 8-10 in number, arranged in a single row. Rostellar hooks measure 0.07-0.129 (0.098) in length. Each rostellar

hook bears a long handle measuring 0.021-0.053 (0.041), a short guard, 0.006-0.018 (0.009) and long blade 0.03-0.057 (0.048).

Neck measures 0.784-1.176 x 0.058-0.21 (0.981 x 0.151). Immature proglottids measure 0.039-0.058 x 0.098-0.215 (0.042 x 0.123); mature proglottids 0.071-0.117 x 0.294-0.392 (0.095 x 0.311) and gravid proglottids 0.098-0.199 x 0.302-0.551 (0.112 x 0.421).

Testes three, two poral and one aporal, arranged in a transverse row. Testes measure 0.029-0.068 x 0.029-0.068 (0.053 x 0.053). Cirrus pouch measures 0.254-0.353 x 0.019-0.045 (0.292 x 0.031), crossing the aporal ventral longitudinal excretory canal. Internal and external seminal vesicles absent.

Female genitalia slightly aporal. Ovary oval, measures 0.01-0.062 x 0.035-0.097 (0.041 x 0.065). Vitelline gland compact, oval to spherical, measures 0.004-0.028 x 0.011-0.058 (0.015 x 0.042). Vagina measures 0.002-0.006 (0.004) in diameter. Vagina opens posterior to the cirrus pouch in the genital atrium. Receptaculum seminis absent.

Genital atrium 0.005-0.014 (0.009) deep and 0.005-0.014 (0.008) wide. Genital openings unilateral, located in the anterior half of the proglottid margin.

Uterus measures 0.05-0.132 x 0.204-0.36 (0.085 x 0.283), sac like, persistent, within the limits of ventral longitudinal excretory canals. Eggs measure 0.012-0.028 x 0.012-0.028 (0.021 x 0.021). Onchospheres measure 0.006-0.016 x 0.008-0.016 (0.012 x 0.012).

Ventral longitudinal excretory canals measure 0.005-0.019 (0.009) in diameter.

DISCUSSION

The present form comes closer to *Drepanidotaenia lateralis* (Mayhew, 1925) and *Drepanidotaenia watsoni* Prestwood and Reid, 1966.

The present form differs from *Drepanidotaenia lateralis* (Mayhew, 1925) in having smaller worms, wider scolex, wider rostellum, larger rostellar hooks, presence of a neck, smaller testes, different extension of cirrus pouch, absence of internal and external seminal vesicles and different extension of the uterus. From *Drepanidotaenia watsoni* Prestwood and Reid, 1966 it differs in having larger scolex, larger rostellum, larger rostellar hooks, smaller testes, larger cirrus pouch which crosses the aporal ventral longitudinal excretory canal, absence of internal and external seminal vesicles, absence of vaginal sphincter and in different extension of the uterus (refer Table 14).

In the light of the above discussion the present form is accommodated as a new species, *Drepanidotaenia pandei* n.sp.

The species is named in honour of Dr. K.C. Pandey, Professor and Head of Zoology Department, Meerut University, Meerut.

Host	-	*Psittacula krameri* (Scopoli)
Habitat	-	Intestine
Locality	-	Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Table 14

Comparison of the characters of the species closer to Drepanidotaenia pandei n.sp.

	D. lateralis (Mayhew,1925)	D. watsoni (Prestwood and Reid,1966)	D. pandei n.sp.
Size	250 x 1.6	70-280 x 2-5	90-170 x 0.55
Scolex	0.16	0.18 x 0.232	0.204-0.313 x 0.196-0.254
Suckers	0.075	0.112-0.12	0.078-0.169 x 0.05-0.119
Rostellum	0.25 x 0.026-0.047	0.175 x 0.088	0.176-0.292 x 0.039-0.109
Rostellar hooks			
Number	8	10	8-10
Size	0.026-0.03	0.01-0.011	0.07-0.129
Neck	Absent	-	Present
Testes size	0.2 x 0.08	0.212-0.302 x 0.171-0.232	0.029-0.068 x 0.029-0.068
Cirrus pouch			
Size	-	1.0-1.1 x 0.04-0.064	0.254-0.353 x 0.019-0.045
Extension in relation to aporal ventral longitudinal excretory canal	Half way across in proglottid	May reach	Crosses
Seminal vesicles			
Internal	Present	Present	Absent
External	Present	Present	Absent
Vaginal sphincter	-	Present	Absent
Uterus	Passes laterally beyond the excretory canals	Passes beyond the excretory canals	Within the limits of ventral excretory canals

Family - Hymenolepididae Railliet *et* Henry, 1909

Subfamily - Hymenolepidinae Perrier, 1897

Genus - *Mayhewia* Yamaguti, 1956

Species - *Mayhewia chauhani* n.sp.

(Plate 16, Figs. 1-3)

Of nine myna, *Acridotheres tristis* (Linnaeus) examined, one was found infected with four cestodes of present form which were present in the small intestine of the host. The morphological studies of the cestodes revealed them to belong to the genus *Mayhewia* Yamaguti, 1956 of the subfamily Hymenolepidinae Perrier, 1897; family Hymenolepididae Railliet *et* Henry, 1909.

Cestodes measure 40-60 (50) in length and 1.176 in maximum width as seen in the gravid proglottids. Strobila consists of a number of proglottids, all broader than long and craspedote.

Scolex measures 0.106-0.215 x 0.127-0.196 (0.182 x 0.168), distinctly demarcated from the neck. Suckers four, unarmed, oval to sperical, measure 0.039-0.078 x 0.027-0.078 (0.051 x 0.043). Rostellum measures 0.04-0.079 x 0.026-0.062 (0.061 x 0.042). Rostellar hooks 12 in number wrench shaped, arranged in a single row, measure 0.012-0.038 (0.028) in length. Handle 0.01-0.028 (0.019), guard

0.002-0.007 (0.005) and blade 0.003-0.008 (0.006) in length.

Neck measures 0.235-0.352 x 0.078-0.127 (0.292 x 0.098). Immature proglottids measure 0.019-0.088 x 0.137-0.196 (0.031 x 0.161); mature proglottids 0.098-0.215 x 0.205-0.785 (0.161 x 0.421) and gravid proglottids 0.206-0.392 x 0.704-1.176 (0.221 x 0.981).

Testes three, oval to round, arranged in a triangle, one poral and two aporal. Testes measure 0.039-0.075 x 0.039-0.075 (0.051 x 0.053), present within the limits of the ventral longitudinal excretory canals. Cirrus pouch oval, measures 0.08-0.196 x 0.029-0.078 (0.103 x 0.052), does not reach the poral ventral longitudinal excretory canal. Internal and external seminal vesicles absent.

Female genitalia median, obliquely situated in the anterior half of the proglottid. Ovary oblique band like, measures 0.01-0.028 x 0.107-0.157 (0.019 x 0.131). Vitelline gland oval to spherical, postovarian, measures 0.018-0.05 x 0.025-0.068 (0.031 x 0.041). Vagina measures 0.002-0.019 (0.009) in diameter. Vagina opens posterior to the cirrus pouch into the genital atrium. Receptaculum seminis measures 0.05-0.152 x 0.021-0.084 (0.071 x 0.062).

Genital atrium 0.005-0.015 (0.008) deep and 0.005-0.021 (0.008) wide. Genital pores unilateral located in the anterior third of the proglottid margin.

Uterus initially bilobed, later occupies the whole of the gravid proglottid. Uterus measures 0.101-0.355 x 0.634-0.882 (0.241 x 0.751), extends laterally beyond the ventral longitudinal excretory canals. Eggs measure 0.015-0.025 x 0.014-0.025 (0.02 x 0.02). Onchospheres measure 0.007-0.019 x 0.007-0.019 (0.011 x 0.011). Embryonic hooks 0.005-0.018 (0.009) in length.

Ventral longitudinal excretory canals measure 0.004-0.038 (0.019) in diameter.

DISCUSSION

The present form comes closer to *Mayhewia ababili* (Singh, 1952) Yamaguti, 1959; *Mayhewia gaughi* (Singh, 1952) Yamaguti, 1959; *Mayhewia kevini* Chishti and Khan, 1982; *Mayhewia levinei* Tandon and Singh, 1963; *Mayhewia macroovata* Sawada and Kugi, 1980, *Mayhewia magna* (Singh, 1952) Yamaguti, 1959, *Mayhewia phasianina* (Fuhrmann, 1907) Yamaguti, 1959, *Mayhewia serpentulus* (Schrank, 1788) Yamaguti, 1959 and *Mayhewia shibuei* Sawada, 1975.

The present form differs from *Mayhewia ababili* (Singh, 1952) Yamaguti, 1959 in having shorter rostellum,

more rostellar hooks, smaller testes, different extension of cirrus pouch, absence of internal and external seminal vesicles, smaller ovary, smaller vitelline gland, smaller eggs and smaller onchosphere. From Mayhewia gaughi (Singh, 1952) Yamaguti, 1959 it differs in having smaller worms, smaller scolex, smaller suckers, more of rostellar hooks, smaller testes, different extension of cirrus pouch, absence of internal and external seminal vesicles, smaller ovary, smaller vitelline gland, smaller eggs, smaller onchosphere and smaller embryonic hooks. From Mayhewia kavini Chishti and Khan, 1982 it differs in having smaller scolex, smaller suckers, more of rostellar hooks, different extension of cirrus pouch, absence of internal and external seminal vesicles and smaller ovary. From Mayhewia levinei Tandon and Singh, 1963 it differs in having larger worms, smaller scolex, smaller suckers, more of rostellar hooks, smaller testes, different extension of cirrus pouch, absence of internal and external seminal vesicles, smaller ovary and smaller vitelline gland. From Mayhewia macroovata Sawada and Kugi, 1980 it differs in having larger worms, smaller suckers, smaller rostellum, more of rostellar hooks, smaller testes, absence of internal and external seminal vesicles, smaller ovary and smaller vitelline gland. From Mayhewia mogna (Singh, 1952) Yamaguti, 1959 it differs in having

smaller worms, smaller scolex, smaller suckers, more of rostellar hooks, smaller testes, smaller cirrus pouch showing different extension, absence of internal and external seminal vesicles, smaller ovary and smaller vitelline gland. From Mayhewia phasianina (Fuhrmann, 1907) Yamaguti, 1959 it differs in having smaller worms, larger scolex, more of rostellar hooks, smaller cirrus pouch which shows different extension, smaller onchosphere and smaller embryonic hooks. From Mayhewia serpentulus (Schrenk, 1788) Yamaguti, 1959 it differs in having smaller worms, more of rostellar hooks, absence of internal and external seminal vesicles, smaller vitelline gland, smaller eggs, smaller onchosphere and smaller embryonic hooks. From Mayhewia shibuei Sawada, 1975 it differs in having smaller scolex, smaller suckers, smaller rostellum, more of rostellar hooks, smaller testes, absence of internal and external seminal vesicle, smaller ovary, smaller eggs and smaller onchospheres (refer Table 15).

In the lines of the above discussion it is proposed to accommodate the present form as a new species, Mayhewia chauhani n.sp.

The species is named in honour of Dr. B.S. Chauhan, Parasitologist, former Vice Chancellor, Saugar University, Sagar (India).

Host	-	Acridotheres tristis (Linnaeus)
Habitat	-	Intestine
Locality	-	Jhansi (U.P.)
Holotype	-	Department of Zoology, Bipin Behari College, Jhansi

Family - Hymenolepididae Railliet *et* Henry, 1909

Subfamily - Hymenolepidinae Perrier, 1897

Genus - *Mayhewia* Yamaguti, 1956

Species - *Mayhewia levinei* Tandon and Singh, 1963

(Plate 17, Figs. 1-5)

Out of twenty one Kasturi birds, *Turdus merula* (Linnaeus) examined, one was found infected with four cestodes of the present form. Cestodes were obtained from the intestine of the host. The morphological studies of the cestodes revealed them to belong to the species *Mayhewia levinei* Tandon and Singh, 1963 of the subfamily Hymenolepidinae Perrier, 1897; family Hymenolepididae Railliet *et* Henry, 1909.

Cestodes measure 40-50 (45) in length and 1.244 in maximum width as seen in the gravid proglottids. Strobila consists of many broader than long and craspedote proglottids.

Scolex measures 0.146-0.225 x 0.205-0.235 (0.195 x 0.212), indistinctly demarcated from the neck. Suckers four, unarmed, oval to spherical, measure 0.079-0.186 x 0.079-0.117 (0.112 x 0.103). Rostellum measures 0.077-0.096 x 0.038-0.062 (0.082 x 0.051). Rostellar sac measures 0.08-0.138 x 0.028-0.092 (0.101 x 0.072). Rostellar hooks

10, wrench shaped, arranged in a single row. Rostellar hooks measure 0.018-0.031 (0.021) in length. Handle 0.013-0.025 (0.019), guard 0.004-0.01 (0.009) and blade 0.003-0.009 (0.007) in length.

Neck measures 0.392-0.452 x 0.175-0.284 (0.421 x 0.211). Immature proglottids measure 0.029-0.098 x 0.196-0.592 (0.058 x 0.348), mature proglottids 0.156-0.294 x 0.626-1.078 (0.199 x 0.958) and gravid proglottids 0.252-0.433 x 0.95-1.244 (0.391 x 1.01).

Testes three, oval to round, arranged in a triangle, one poral and two aporal. Testes measure 0.076-0.148 x 0.076-0.141 (0.098 x 0.095), present within the limits of the ventral longitudinal excretory canals. Cirrus pouch measures 0.146-0.236 x 0.028-0.082 (0.192 x 0.062), oval and extends beyond the poral ventral longitudinal excretory canal. Internal seminal vesicle measures 0.104-0.188 x 0.016-0.047 (0.161 x 0.025); external seminal vesicle 0.101-0.177 x 0.04-0.111 (0.123 x 0.091).

Female genitalia median. Ovary follicular, measures 0.041-0.127 x 0.168-0.294 (0.098 x 0.212). Vitelline gland postovarian, measures 0.021-0.049 x 0.035-0.088 (0.032 x 0.062). Vagina measures 0.002-0.018 (0.009) in diameter, opens posterior to the cirrus pouch in the genital atrium. Receptaculum seminis measures 0.117-0.197 x 0.016-0.118 (0.142 x 0.062).

Genital atrium 0.028-0.048 (0.039) deep and 0.031-0.066 (0.051) wide. Genital pores unilateral, located in the anterior half of the proglottid margin.

Uterus sac like, measures 0.133-0.385 x 0.611-0.912 (0.251 x 0.785), laterally extending upto the ventral longitudinal excretory canals. Uterus filled up with a large number of eggs.

Eggs measure 0.014-0.055 x 0.014-0.055 (0.034 x 0.035). Onchospheres measure 0.01-0.029 x 0.011-0.029 (0.018 x 0.019). Embryonic hooks measure 0.011-0.029 (0.02) in length.

Ventral longitudinal excretory canals, 0.009-0.039 (0.022) in diameter.

DISCUSSION

A comparison of the present form with the reported species of the genus Mayhewia Yamaguti, 1956 reveals it to represent Mayhewia levinei Tandon and Singh, 1963 (refer Table 16). The minor differences between the measurements of two are not of much significance. The occurrence of Mayhewia levinei Tandon and Singh, 1963 in Jhansi region indicates its wider distribution as the species has so far been reported from Lucknow only.

It is thus concluded that the size of various organs be considered as follows. Worms 13.2-50 x 0.364-1.244; scolex diameter 0.208-0.28; suckers diameter 0.079-0.117; rostellum diameter 0.038-0.062; rostellar hooks 0.018-0.031 long; testes diameter 0.076-0.141; cirrus pouch 0.146-0.236 x 0.028-0.082; ovary width 0.15-0.294; vitelline gland 0.035-0.10 wide and receptaculum seminis 0.016-0.118 wide.

Host - *Turdus merula* (Linnaeus)

Habitat - Intestine

Locality - Jhansi (U.P.)

Holotype - Department of Zoology,
Bipin Behari College, Jhansi

Table 16

Comparison of the present form with Mayhewia levinei Tandon and Singh, 1963

	Mayhewia levinei (Tandon and Singh, 1963)	Mayhewia levinei (Present form)
Size	13.2-33.1 x 0.364-0.7	40-50 x 1.244
Scolex (width)	0.23-0.28	0.205-0.235
Sucker (width)	0.086-0.092	0.079-0.117
Rostellum (width)	0.04-0.052	0.038-0.062
Rostellar hooks		
Number	10	10
Size	0.022-0.026	0.018-0.031
Testes (width)	0.106-0.122	0.076-0.141
Cirrus pouch		
Size	0.16-0.19 x 0.05-0.062	0.146-0.236 x 0.028-0.082
Ovary		
Width	0.15-0.24	0.168-0.294
Shape	Lobed with 5-6 lobes	Follicular
Vitelline gland	0.064-0.1	0.035-0.088
Receptaculum seminis	0.07-0.074	0.016-0.118

Family - Amabiliidae Fuhrmann, 1908

Genus - Proterandria n.g.

Species - Proterandria jhansiensis n.g., n.sp.

(Plate 18, Figs. 1-7)

Three out of ten little grebs, Podiceps ruficollis (Pallas) examined at Baruwasagar, District Jhansi, harboured twelve cestodes in their intestine. The morphological studies of the cestodes revealed them to belong to the new genus Proterandria n.g. of the family Amabiliidae Fuhrmann, 1908.

Amended diagnosis of the family : Amabiliidae

Cyclophyllides: Small to medium size worms with an armed rostellum. Proglottids with lateral marginal outgrowth upon which the male apertures may or may not open. Genitalia single or partly double; single genital pores alternating regularly or irregularly. Vaginal aperture communicating with excretory vessel or lacking, but sometimes replaced in function by an accessory canal which opens to the out side. Eggs with a thin transparent shell. Parasites of birds.

Proterandria n.g.

Generic diagnosis: Medium sized worms. Rostellum armed with a single crown of 40-50 rostellar hooks. Rostellar

hooks with handle short and a guard longer than the blade. Suckers unarmed. Proglottids extremely craspedote. Proterandrous. Single set of genitalia per proglottids. Testes numerous (40-60) in two fields. Internal seminal vesicle present. Cirrus spinose. Male genital pores regularly alternating. Ovary transversely extended. Vitelline gland lobed. Vagina absent. Receptaculum seminis of different proglottids connected by a medial duct. Receptaculum seminis opens to outside by an accessory canal opposite to the male genital pore. Initially uterus bilobed later on transversely elongated sac; occupies the whole gravid proglottid. Parasites of aquatic birds.

<u>Proterandria jhansiensis</u> n.g., n.sp.

Cestodes measure 14-27 (20) in length and 2.836 in maximum width. Proglottids broader than long, extremely craspedote.

Scolex measures 0.47-0.688 x 0.604-0.901 (0.551 x 0.831). Suckers four, unarmed, oval to round, measure 0.185-0.323 x 0.185-0.294 (0.281 x 0.221). Rostellum oval, measures 0.04-0.15 x 0.102-0.241 (0.081 x 0.161). Rostellum provided with 40-50 (44) rostellar hooks, arranged in a single row. Rostellar hooks measure 0.031-0.056 (0.045) in length. Each rostellar hooks contain a short handle

and a guard longer than the blade. Handle measures 0.001-0.008 (0.004), guard 0.015-0.041 (0.025) and the blade 0.01-0.03 (0.024) in length.

Neck absent. Immature proglottids measure 0.022-0.098 x 0.701-1.215 (0.065 x 0.985); mature proglottids 0.215-0.901 x 0.813-2.536 (0.481 x 1.821) and gravid proglottids 0.381-1.081 x 1.22-2.836 (0.781 x 1.891).

Proterandrous. Testes 40-60 (50) in number, oval to round, arranged in two groups on each side of female genitalia. Each poral and aporal group contains 19-33 (26) and 18-27 (24) testes respectively. Testes measure 0.019-0.058 x 0.019-0.058 (0.04 x 0.04). Cirrus pouch oval, measures 0.156-0.484 x 0.058-0.277 (0.321 x 0.132). Internal seminal vesicle measures 0.101-0.335 x 0.03-0.202 (0.251 x 0.085). External seminal vesicle absent. Cirrus armed.

Female genitalia median. Ovary transversely extended, lobulated, measures 0.02-0.195 x 0.06-1.104 (0.081 x 0.095), attains maturity after the disappearance of male organs. Vitelline gland lobulated, postovarian, measures 0.02-0.152 x 0.08-0.245 (0.085 x 0.168). Vagina absent. Receptaculum seminis oval to round, measures 0.02-0.08 x 0.02-0.08 (0.06 x 0.06), located at the

anteriomedial region of proglottid, provided by an accessory canal which opens opposite to male genital pore. Accessory canal measure 0.01-0.03 (0.02) in diameter. Receptaculum seminis of different proglottids connected by a medial duct.

Genital pore 0.05-0.07 (0.06) deep and 0.05-0.122 (0.08) wide. Male genital pores alternate regularly, located in the anterior half of the proglottid margin.

Uterus initially a bilobed sac lateron extends transversely and occupies the whole proglottid. Uterus measures 0.31-0.598 x 1.27-1.88 (0.42 x 1.321). Uterus filled up with a large number of eggs. Eggs measure 0.011-0.033 x 0.011-0.033 (0.025 x 0.021). Onchospheres measure 0.01-0.016 x 0.01-0.016 (0.014 x 0.014).

Ventral longitudinal excretory canals could not be seen.

DISCUSSION

Yamaguti, 1959 has included three genera in the family Amabiliidae Fuhrmann, 1908 viz., Amabilia Diamare, 1893; Schistotaenia Cohn, 1900 and Tatria Kowalewski, 1904.

The present form differs from Amabilia Diamare, 1893 in having single set of genitalia, transversely

extended ovary and lobed vitelline gland. From *Schistotaenia* Cohn, 1900 it differs in having the absence of spines on the scolex, different arrangement of testes, regularly alternating male genital pores and accessory duct which opens opposite to male genital pore. From Tatria Kowalewski, 1904 it differs in having greater number of rostellar hooks, absence of spine like hairs on scolex, rostellum, suckers and strobila, more testes, absence of vagina, different position of receptaculum seminis and accessory canal which always opens opposite to the male genital pore.

In the light of the above discussion it is proposed to accommodate the present form as a new genus and a new species, *Protexandria jhansiensis* n.g., n.sp.

Host - *Podiceps ruficollis* (Pallas)

Habitat - Intestine

Locality - Baruwasagar, Jhansi (U.P.)

Holotype - Department of Zoology,
Bipin Behari College, Jhansi

Key to the various genera of the family Amabiliidae, Fuhrmann, 1908

1. Male genitalia double per proglottid, ovary and vitelline gland dendritic ... *Amabilia*

Male genitalia single per proglottid, ovary and vitelline gland not dendritic ... 2

2. Vagina present ... *Tatria*

Vagina absent or replaced by an accessory canal ... 3

3. Testes many; male genital pore alternating regularly, vagina absent; receptaculum seminis of different proglottids connected by a medial duct. Receptaculum seminis opens to outside by an accessory canal opposite to the male genital pore ... *Proterandria* n.g.

Testes numerous; male genital pore alternating irregularly; vagina replaced in function by a dorsoventral canal opening on both surfaces ... *Schistotaenia*

Family - Dioecocestidae Southwell, 1930
Subfamily - Dioecocestinae Fuhrmann, 1936
Genus - Dioecocestus Fuhrmann, 1900
Species - Dioecocestus indica n.sp.
(Plate 19, Figs. 1-4)
(Plate 20, Figs. 1-6)

Six little grebes, Podiceps ruficollis (Pallas) were examined at Baruwasagar, District Jhansi (U.P.). Each host was found infected in its intestine with two cestodes, one male another female. Thus six male and six female cestodes were collected. Morphological studies of the cestodes revealed them to belong to the genus Dioecocestus Fuhrmann, 1900 of the subfamily Dioecocestinae Fuhrmann, 1936 and family Dioecocestidae Southwell, 1930.

MALE

Cestodes measure 45-150 in length and 4.982 in maximum width as seen in mature proglottids. The strobila consists of a large number of craspedote and broader than long proglottids.

Scolex measures 0.352-0.842 x 0.36-0.884 (0.625 x 0.712). Suckers unarmed, oval to round, measure 0.117-0.255 x 0.117-0.275 (0.201 x 0.201). Rostellum protrusible, longer than broad, measures 0.625-0.823 x 0.048-0.313 (0.721 x 0.212). Rostellum bears 16-24 large

rostellar hooks, arranged in a single row. Rostellar hooks measure 0.123-0.281 (0.201) in length. Handle measure 0.073-0.156 (0.098), guard 0.01-0.04 (0.025) and blade 0.051-0.147 (0.098) in length.

Neck absent. Immature proglottids measure 0.021-0.098 x 0.486-1.472 (0.072 x 0.982) and mature proglottids 0.137-0.686 x 1.528-4.982 (0.352 x 3.231).

Male genitalia double. Testes 45-90 (70) in number, round, distributed in one group within the limits of ventral longitudinal excretory canals. Testes measure 0.025-0.078 x 0.025-0.078 (0.045 x 0.045). Cirrus pouch measures 0.306-0.688 x 0.039-0.217 (0.521 x 0.151), cylindrical, reaches upto the ventral longitudinal excretory canal. Internal seminal vesicle measures 0.08-0.192 x 0.035-0.065 (0.105 x 0.048). External seminal vesicle absent. Cirrus prominent measures 0.153-0.401 x 0.01-0.045 (0.281 x 0.031), armed with many rows of spines. Cirrus spines measure 0.003-0.01 (0.006) in length.

Genital pore 0.072-0.206 (0.151) deep and 0.059-0.198 (0.121) wide. Genital openings bilateral, situated in the anterior one fourth region of the proglottid margin.

Dorsal longitudinal excretory canals measure 0.03-0.09 (0.07) and ventral longitudinal excretory canals 0.025-0.087 (0.072) in diameter.

FEMALE

Cestodes measure 40-140 (110) in length and 7.842 in maximum width as seen in the gravid proglottids. All proglottids broader than long. Immature and anterior mature proglottids acraspedote; posterior mature and gravid proglottids craspedote.

Scolex measures 0.356-0.882 x 0.486-1.203 (0.682 x 0.822). Suckers four, unarmed, measure 0.081-0.196 x 0.126-0.296 (0.125 x 0.212). Rostellum protrusible, longer than broad, measures 0.548-0.767 x 0.04-0.341 (0.621 x 0.201). Rostellum bears 20-26 (24) rostellar hooks arranged in a single row. Shape of the rostellar hooks similar to that of the male. Rostellar hooks measure 0.201-0.033 (0.301) in length. Handle measures 0.077-0.168 (0.101), guard 0.01-0.043 (0.031) and blade 0.06-0.151 (0.108) in length.

Neck absent. Immature proglottids measure 0.039-0.254 x 0.951-1.998 (0.162 x 1.201), mature proglottids 0.156-0.529 x 1.961-5.882 (0.351 x 3.261) and gravid proglottids 0.594-1.178 x 4.921-7.842 (0.892 x 6.021).

Female genitalia single per proglottid. Ovary measures 0.03-0.137 x 0.225-0.314 (0.101 x 0.421), slightly aporal and lobed. Vitelline gland measures 0.03-0.098 x 0.038-0.119 (0.061 x 0.082), compact, oval to rectangular and postovarian. Irregularly alternating vagina does not

open to exterior. Vagina differentiated into copulatory and conducting regions. Copulatory region measures 0.161-0.331 x 0.025-0.125 (0.351 x 0.085); conducting region measures 0.605-1.02 x 0.016-0.056 (0.951 x 0.041). Receptaculum seminis measures 0.071-0.253 x 0.031-0.152 (0.118 x 0.092). Ootype measures 0.04-0.078 x 0.04-0.08 (0.066 x 0.068).

Uterus measures 0.25-0.918 x 2.511-6.03 (0.591 x 4.38), initially appears as a transverse tube but lateron becomes sac like with numerous outgrowths. Laterally the uterus extends beyond the ventral longitudinal excretory canals. Eggs measure 0.025-0.05 x 0.025-0.05 (0.032 x 0.032). Onchospheres measure 0.012-0.025 x 0.012-0.025 (0.019 x 0.019).

Dorsal longitudinal excretory canals measure 0.03-0.12 (0.091) and ventral longitudinal excretory canals, 0.032-0.111 (0.08) in diameter.

DISCUSSION

The present form comes closer to Dioecocestus fevita Meggitt, 1933; Dioecocestus fuhrmanni Linton, 1925 and Dioecocestus novae-guinese Fuhrmann, 1914.

The present form differs from Dioecocestus fevita Meggitt, 1933 as follows; Male differs in having wider strobila, presence of rostellar hooks, smaller cirrus

pouch which never crosses the poral ventral longitudinal excretory canals, longer cirrus, smaller cirrus spines and different location of male genital pore. Females differ in having wider worms, smaller suckers and shorter rostellum. From *Dioecocestus fuhrmanni* Linton, 1925 it differs as follows; Males differ in having wider scolex, presence of suckers, presence of rostellar hooks, fewer testes in single field, smaller cirrus pouch, narrower cirrus and smaller cirrus spines. Females differ in having wider worms and smaller vitelline gland. From *Dioecocestus novae-guineae* Fuhrmann, 1914 it differs as follows; Males differ in having larger scolex, smaller cirrus pouch, armed cirrus and different location of male genital pores. Females differ in having wider worms, larger number of rostellar hooks, different disposition of ovary and different shape of vitelline gland (refer Table 17).

In the light of the above discussion it is proposed to accommodate the present form as a new species, *Dioecocestus indica* n.sp.

Host - *Podiceps ruficollis* (Pallas)

Habitat - Intestine

Locality - Baruwasagar, Jhansi (U.P.)

Holotype - Department of Zoology,
Bipin Behari College, Jhansi

Table 18

Comparison of the sexually dimorphic characters of the male and female worms of *Dioecocestus indica* n.sp.

	Male	Female
Size	45-150 x 4.982	40-140 x 7.842
Scolex	0.352-0.842 x 0.36-0.884	0.356-0.882 x 0.486-1.203
Suckers	0.117-0.255 x 0.117-0.275	0.081-0.196 x 0.126-0.296
Rostellum	0.625-0.823 x 0.048-0.313	0.548-0.767 x 0.04-0.341
Rostellar hook		
Number	16-24	20-26
Size	0.123-0.281	0.201-0.333
Handle	0.075-0.156	0.077-0.168
Guard	0.01-0.04	0.01-0.043
Blade	0.051-0.147	0.06-0.151
Immature proglottid	0.021-0.098 x 0.486-1.472	0.039-0.254 x 0.951-1.998
Mature proglottid	0.137-0.686 x 1.528-4.982	0.136-0.529 x 1.961-5.882

Family - Dioecocestidae Southwell, 1930

Subfamily - Gyrocoeliinae Yamaguti, 1959

Genus - Infula Burt, 1939

Species - Infula limosai n.sp.

(Plate 21, Figs. 1-4)

(Plate 22, Figs. 1-5)

One out of the four Khag bird, Limosa limosa (Linnaeus) examined at Garghmau, District Jhansi, was found infected with two cestodes, one male and the other female. The cestodes were present in the intestine of the host. Morphological studies revealed them to belong to the genus Infula Burt, 1939 of the subfamily Gyrocoeliinae Yamaguti, 1959; family Dioecocestidae Southwell, 1930.

MALE

Cestode measures 80 in length and 1.957 in maximum width as seen in the mature proglottids. Strobila consists of a number of craspedote proglottids, all broader than long.

Scolex not well demarcated from the neck. Scolex measures 0.305 x 0.325. Suckers four, unarmed, oval, measure 0.182-0.222 x 0.107-0.132 (0.201 x 0.121). Rostellum protrusible, oval, measures 0.144 x 0.071. Rostellar hooks absent.

Neck measures 0.101 x 0.245-0.284. Immature proglottids measure 0.028-0.171 x 0.288-0.703 (0.095 x 0.551) and mature proglottids 0.195-0.779 x 0.803-1.957 (0.452 x 1.214).

Testes 36-50 (45) in number, oval to round, distributed in one group within the limits of ventral longitudinal excretory canals. Testes measure 0.03-0.076 x 0.031-0.079 (0.052 x 0.056). Cirrus pouch club shaped, measures 0.38-0.779 x 0.05-0.268 (0.582 x 0.151), well past the poral ventral longitudinal excretory canal. Internal seminal vesicle measures 0.301-0.642 x 0.3-0.201 (0.421 x 0.103). External seminal vesicle absent. Cirrus measures 0.101-0.303 (0.212) in length, heavily armed with spines. Cirrus spines measure 0.005-0.011 (0.009) in length. Male genital pores irregularly alternating, located in the middle of the proglottid margin.

Ventral longitudinal excretory canal measures 0.02-0.058 (0.042) in diameter. Dorsal longitudinal excretory canal measures 0.012-0.049 (0.03) in diameter.

<u>FEMALE</u>

Cestode measures 120 in length and 3.852 in maximum width as seen in the gravid proglottids. Strobila consists of numerous proglottids, all craspedote and broader than long.

Scolex not well demarcated from the neck. Scolex measures 0.25 x 0.266. Suckers four, unarmed, oval to spherical, measure 0.16-0.19 x 0.1-0.115 (0.175 x 0.107). Rostellum oval, protrusible, measures 0.118 x 0.068. Rostellar hooks absent.

Neck measures 0.12 x 0.198-0.251. Immature proglottids measure 0.019-0.098 x 0.255-0.333 (0.058 x 0.291); mature proglottids 0.125-0.412 x 0.395-1.764 (0.315 x 1.02) and gravid proglottids 0.142-0.725 x 1.642-3.852 (0.598 x 2.514).

Female genitalia median. Ovary bilobed, transversely extended, measures 0.052-0.323 x 0.235-0.901 (0.202 x 0.653). Vitelline gland postovarian, compact, measures 0.049-0.157 x 0.102-0.342 (0.091 x 0.243). Ootype round, measures 0.051-0.102 x 0.051-0.118 (0.081 x 0.082). Vagina apparently identical to cirrus pouch, with heavy muscular wall and typical armed duct. Distal part of vagina eversible. Vagina differentiated in copulatory and conducting regions. Copulatory region measures 0.201-0.683 x 0.032-0.152 (0.451 x 0.098). Conducting region measures 0.162-0.331 x 0.011-0.031 (0.251 x 0.021). Receptaculum seminis measures 0.058-0.157 x 0.035-0.092 (0.084 x 0.062). Genital pores irregularly alternating, located in the middle of the proglottid margin.

Uterus initially ring like but lateron develops numerous outgrowths. Uterus measures 0.05-0.51 x 0.944-2.235 (0.352 x 1.651), extended within the limits of ventral longitudinal excretory canals. Eggs measure 0.011-0.068 x 0.011-0.066 (0.052 x 0.052). Onchospheres measure 0.009-0.049 x 0.009-0.04 (0.03 x 0.03). Embryonic hooks measure 0.007-0.025 (0.018) in length.

Ventral longitudinal excretory canals measure 0.019-0.054 (0.034) in diameter.

DISCUSSION

The present form comes closer to Infula macrophallus Coil, 1955. However, it differs from Infula macrophallus Coil, 1955 as follows; Male differs in having larger worm, smaller scolex, narrower suckers, oval rostellum, broader than long proglottids, smaller testes and absence of external seminal vesicle. Female differs in having smaller worm, smaller scolex, smaller suckers and oval rostellum (refer Table 19).

In the light of the above discussion the present form is accommodated as a new species, Infula limosai n.sp.

Host - Limosa limosa (Linnaeus)
Habitat - Intestine
Locality - Garghmau, Jhansi (U.P.)
Holotype - Department of Zoology, Bipin Behari College, Jhansi

Table 19

Comparison of the characters of *Infula macrophallus* Coil, 1955 and *Infula limosai* n.sp.

	Infula macrophallus Coil, 1955	*Infula limosai* n.sp.
MALE		
Size	34 x 1.47	80 x 1.957
Scolex	0.3	0.305 x 0.325
Suckers	0.18-0.22 x 0.22-0.25	0.182-0.222 x 0.107-0.132
Rostellum	Conical	Oval
Proglottids	As long as broad	Broader than long
Testes	0.09-0.093	0.03-0.076 x 0.031-0.079
Cirrus	0.14-0.18	0.101-0.303
External seminal vesicle	Present	Absent
FEMALE		
Size	145 x 4.9	120 x 3.852
Scolex	0.53	0.25 x 0.266
Suckers	0.25-0.27 x 0.32-0.36	0.16-0.19 x 0.1-0.115
Rostellum	Conical	Oval

Table 20

Comparison of the sexually dimorphic characters of the male and female worms of *Infula limosai* n.sp.

	Male	Female
Size	80 x 1.957	120 x 3.852
Scolex	0.305 x 0.325	0.25 x 0.266
Suckers	0.182-0.222 x 0.107-0.132	0.16-0.19 x 0.1-0.115
Rostellum	0.135 x 0.071	0.118 x 0.068
Neck	0.101 x 0.245-0.284	0.12 x 0.198-0.251
Proglottids		
Immature	0.028-0.171 x 0.288-0.703	0.019-0.098 x 0.255-0.333
Mature	0.195-0.779 x 0.803-1.957	0.125-0.412 x 0.395-1.764
Ventral longitudinal excretory canal	0.02-0.058	0.019-0.054

Family - Dioecocestidae Southwell, 1930

Subfamily - Hymenocoelinae Capoor and Srivastava, 1964

Genus - Hymenocoelia Capoor and Srivastava, 1964

Species - Hymenocoelia liviana n.sp.

(Plate 23, Figs. 1-6)

One out of five pigeons, Columba livia (Gmelin) examined, was found infected with seven cestodes. Cestodes were present in the intestine of the host. The morphological studies of the cestodes revealed them to belong to the genus Hymenocoelia Capoor and Srivastava, 1964 of the subfamily Hymenocoelinae Capoor and Srivastava, 1964; family Dioecocestidae Southwell, 1930.

Cestodes measure 110-130 in length and 0.548 in maximum width as seen in the gravid proglottids. Strobila consists of several craspedote and broader than long proglottids.

Scolex measures 0.205-0.294 x 0.061-0.166 (0.215 x 0.098), indistinctly demarcated from the neck. Suckers four, unarmed, oval, measure 0.078-0.122 x 0.021-0.098 (0.099 x 0.071). Rostellum oval, measures 0.122-0.223 x 0.039-0.105 (0.168 x 0.081). Rostellar hooks 10-12 in number, arranged in a single row. Rostellar hooks measure 0.088-0.117 (0.099) in length. Handle measures 0.027-0.046

(0.032), guard 0.003-0.007 (0.005) and blade 0.031-0.05 (0.042) in length.

Neck prominent, measures 2.548-3.136 x 0.031-0.098 (2.982 x 0.075).

MALE

Anterior male proglottids measure 0.07-0.145 x 0.212-0.365 (0.011 x 0.312). Testes 3, medial, oval to round, arranged almost in a transverse row. Testes measure 0.028-0.058 x 0.028-0.058 (0.041 x 0.041). Cirrus pouch elongate, well past the middle of the proglottid, measures 0.15-0.435 x 0.007-0.058 (0.289 x 0.032). Internal seminal vesicle measures 0.098-0.389 x 0.004-0.049 (0.261 x 0.025). External seminal vesicle absent. Cirrus armed.

FEMALE

Posterior female proglottids measure 0.078-0.169 x 0.271-0.452 (0.098 x 0.351) and gravid proglottids measure 0.078-0.197 x 0.452-0.548 (0.121 x 0.501). Ovary single, bilobed, slightly aporal, measures 0.02-0.058 x 0.142-0.238 (0.032 x 0.196), transversely extended within the limits of ventral longitudinal excretory canals. Vitelline gland compact, oval, postovarian, measures 0.022-0.045 x 0.03-0.089 (0.035 x 0.065). Vagina measures 0.008-0.015 (0.011) in diameter. Receptaculum sêminis

measures 0.021-0.057 x 0.012-0.04 (0.041 x 0.03), situated at the proximal end of the vagina. Cirrus pouch persists in female proglottids. Cirrus pouch measures 0.201-0.358 x 0.02-0.056 (0.263 x 0.041).

Genital atrium 0.012-0.027 (0.021) deep and 0.01-0.025 (0.02) wide. Genital openings unilateral, located at the anterior half of the proglottid margin. Vagina opens posterior to the cirrus pouch in the genital atrium.

Uterus appears as a transverse sac, measures 0.038-0.09 x 0.351-0.582 (0.071-0.421), laterally extended beyond the ventral longitudinal excretory canals. Eggs oval to round, measure 0.012-0.022 x 0.012-0.022 (0.018 x 0.018). Onchospheres measure 0.003-0.009 x 0.003-0.009 (0.006 x 0.006).

Ventral longitudinal excretory canals measure 0.01-0.031 (0.021) in diameter.

DISCUSSION

So far only one species of the genus *Hymenocoelia* Capoor and Srivastava, 1964 has been reported, viz., *Hymenocoelia chauhani* Capoor and Srivastava, 1964. The present form differs from *Hymenocoelia chauhani* Capoor and Srivastava, 1964 in having smaller scolex, narrower suckers, smaller rostellum, smaller rostellar hooks, absence of

external seminal vesicle, different extension and disposition of ovary, oval vitelline gland and smaller eggs (refer Table 21).

In the light of the above discussion the present form is accommodated as a new species, Hymenocoelia liviana n.sp.

Host - Columba livia (Gmelin)

Habitat - Intestine

Locality - Jhansi (U.P.)

Holotype - Department of Zoology, Bipin Behari College, Jhansi

Table 21

Comparison of the characters of *Hymenocoelia chauhani* Capoor and Srivastava, 1964 and *Hymenocoelia liviana* n.sp.

	Hymenocoelia chauhani Capoor and Srivastava, 1964	*Hymenocoelia liviana* n.sp.
Scolex	0.3 x 0.32	0.205-0.294 x 0.061-0.166
Suckers	0.12 dia.	0.078-0.122 x 0.021-0.098
Rostellum	0.34 x 0.1	0.122-0.223 x 0.039-0.105
Rostellar hooks	0.12	0.088-0.117
Testes	0.02-0.07	0.028-0.058 x 0.028-0.058
Cirrus pouch	0.28 x 0.04	0.15-0.435 x 0.007-0.058
Seminal vesicle		
Internal	Present	Present
External	Present	Absent
Ovary		
Disposition	Oblique	Transverse
Extension in relation to excretory canal	Beyond	Within the limit
Vitelline gland	Bilobed	Oval
Eggs	0.02-0.03	0.012-0.022

Key to the species of the genus *Hymenocoelia* Capoor and Srivastava, 1964

Ovary extended beyond the limits of ventral longitudinal excretory canals. External seminal vesicle present	... *H. chauhani*
Ovary does not extend beyond the limits of ventral longitudinal excretory canals. External seminal vesicle absent	... *H. liviana* n.sp.

PART- C

OBSERVATIONS

To study the nature of cestode infection in the domestic fowl, Gallus gallus (Linnaeus) ninetyeight birds were sacrificed (about four hosts per month) for two successive years from November 1985 to October 1987. Out of the 98 hosts examined, 80 were found infected with 2155 cestodes. Thus the average annual prevalence of cestode infection in fowls was (0.816); mean intensity (26.93) and the relative density as (21.98). Only 227 nematodes were obtained from 39 fowls. Thus the prevalence of nematode infection was (0.397); mean intensity (5.82) and the relative density as (2.316) (Table 22, Plate 24). Only 5 trematodes were obtained from one fowl. Thus the prevalence of trematode infection was (0.0102); mean intensity (5.00) and relative density as (0.051) (Table 22, Plate 24). Thus the cestodes predominate the helminth infection in the fowls. Average seasonal variations in the prevalence, mean intensity and relative density of cestodes infecting the fowls are as follows. The prevalence of cestode infection was highest during winter season (0.909) and lowest in summer (0.633) (Table 23, Plate 25). The mean intensity of cestode infection was highest during winter (37.16) and lowest during summer (19.21) (Table 23, Plate 25). The relative density of cestode infection was

also highest in winter season (33.78) and lowest during summer (12.16) (Table 23, Plate 25). Average monthwise variations in the prevalence, mean intensity and relative density of the cestode infection in fowls have been depicted in (Table 24, Plate 26). The maximum prevalence (1.00) was recorded in the months of November, February, March, August and September whereas minimum (0.111) in June. In rest of the months it ranges from 0.666 to 0.9. The maximum mean intensity (42.42) was recorded in January whereas minimum (8.00) in June. In rest of the months it ranges from 12.2 to 41.42. The relative density (37.77) was maximum in the month of November whereas minimum (0.88) in June. In rest of the months it ranges from 8.71 to 37.12.

I) Cestode infection in relation to the body weight of the host:

(a) <u>Average annual variations</u> (Table 25, Plate 27)

<u>Prevalence</u>: Maximum prevalence (0.916) was recorded in the host ranging from 750-1050 gm. in weight while minimum prevalence of cestode infection (0.5) was recorded in the host ranging from 1951-2250 gm. in weight.

<u>Mean intensity</u>: Maximum mean intensity of the cestode infection (39.72) was recorded in the hosts ranging from 750-1050 gm. in weight. The mean intensity was minimum (20.91) in the hosts ranging from 1351-1650 gm. in weight.

Relative density: Maximum relative density of the cestode infection (36.41) was recorded in the hosts ranging from 750-1050 gm. in weight. The relative density was minimum (17.33) in the body weight range of 1651-1950 gm.

(b) Average seasonal variations (Table 26 (A,B,C,D,E); Plate 28, 29)

Prevalence: The maximum prevalence (1.00) was recorded in the hosts weight ranging from 750-1050 gm. during winter and summer, in 1351-1650 gm. during rainy season and in 1651-1950 gm. during winter and rainy season.

The minimum prevalence (0.142) was recorded in the host body weight ranging from 1651-1950 gm. during summer.

Mean intensity: The maximum mean intensity of the cestode infection was (68.00) as recorded in the host body weight ranging from 1951-2250 gm. during winter.

The minimum mean intensity of the cestode infection (8.00) was recorded in the host body weight ranging from 1651-1950 gm. during summer.

Relative density: The maximum relative density of cestode infection (49.00) was recorded in the host body weight ranging from 750-1050 gm. during winter.

The minimum relative density of cestode infection (1.14) was recorded in the host body weight ranging from 1651-1950 gm. during summer.

(c) Average monthwise variations (Table 27 (A,B,C,D,E); Plate 30,31,32,33,34)

Prevalence: In the host body weight ranging from 750-1050 gm. the maximum prevalence (1.00) was recorded in November, December, January, February, March, April, August and September whereas minimum (0.5) in July. During the month of May, June and October no host of this body weight range was examined. In the body weight range of 1051-1350 gm. the maximum prevalence (1.00) was recorded in the months of November, January, February, March, April, May, July, August and September while minimum (0) was recorded in the months of June and October. In the body weight range of 1351-1650 gm. the maximum prevalence (1.00) was recorded in the months of November, December, February, March, April, July, September and October, while minimum prevalence (0) was recorded in the month of June. No host of this body weight range was examined in August. In the host body weight range of 1651-1950 gm. the maximum prevalence (1.00) was recorded in the months of November, December, January, February, July, August, September and October while minimum (0.142) in June. No host of this body weight range was examined in March, April and May. In the host body weight range of 1951-2250 gm. the maximum prevalence (1.00) was recorded in February and March whereas minimum (0) was recorded in December and April. No host of this body weight range was examined in the months of November, January, May, June, July, August and September.

<u>Mean intensity</u>: In the hosts body weight ranging from 750-1050 gm. the maximum mean intensity (78.00) was in November and minimum (7.00) in February. In rest of the months it ranges from 26.00 to 60.00 except May, June and October when the birds of this weight range could not be examined. In the body weight ranging from 1051-1350 gm. the maximum mean intensity (57.00) was recorded in December while the minimum mean intensity (0) was recorded in the months of June and October. In rest of the months it ranges from 12.75-43.5. In the host body weight ranging from 1351-1650 gm. the maximum mean intensity (36.00) was recorded in the months of September while minimum (0) was recorded in June. In rest of the months it ranges from 6.00 to 31.25 except August when birds of this body weight range could not be examined. In the host body weight range of 1651-1950 gm. the maximum mean intensity (63.00) was recorded in the month of December while minimum (8.00) was recorded in June. In rest of the months it ranges from 13.00 to 28.00 except March, April and May when birds of this body weight range could not be examined. Hosts belonging to the body weight range of 1951-2250 gm. showed the maximum mean intensity (68.00) in the month of February while minimum (0) was recorded in the months of December and April. In March it was 29.00 and in October 21.0. In rest of the months the birds of this body weight range could not be examined.

Relative density: In the host body weight range of 750-1050 gm. the maximum relative density (78.00) was recorded in November and minimum (7.00) in February. In rest of the months it ranges from 24.5 to 60.00 except May, June and October when birds of this body weight range could not be examined. In the host body weight range of 1051-1350 gm. the maximum (43.5) was recorded in the month of January while minimum (0) was in June and October. In rest of the months it ranges from 12.75-38.33. In the host body weight range of 1351-1650 gm. the maximum relative density (36.00) was in September while minimum (0) was recorded in June. In rest of the months it ranges from 2.00 to 31.25 except August when the birds of this body weight range could not be examined. In the host body weight range of 1651-1950 gm. the maximum relative density (63.00) was in December whereas minimum (1.14) in June. In rest of the months it ranges from 13.00 to 28.00 except March, April and May when the birds of this body weight range could not be examined. Hosts belonging to the body weight range of 1951-2250 gm. showed the maximum relative density (68.00) in February while the minimum (0) was in the months of April and December. In the month of March it was 29.00 and in October 10.5. In rest of the months the birds of this body weight range could not be examined.

II) **Cestode infection in relation to the weight of alimentary canal of the host:**

(a) Average annual variations (Table 28, Plate 35)

Prevalence: The maximum prevalence (0.932) was recorded in the hosts with alimentary canal weight ranging from 61-85 gm. while minimum prevalence of cestode infection (0.615) was recorded in the hosts with alimentary canal weight ranging from 111-135 gm.

Mean intensity: The maximum mean intensity of the cestode infection (31.6) was recorded in the hosts with alimentary canal weight ranging from 35-60 gm. while the minimum mean intensity of cestode infection (21.31) was recorded in the hosts with alimentary canal weight ranging from 111-135 gm.

Relative density: The maximum relative density of the cestode infection (29.25) was recorded in the hosts with alimentary canal weight ranging from 35-60 gm. while it was minimum (13.11) in the hosts with alimentary canal weight ranging from 111-135 gm.

(b) Average seasonal variations (Table 29 (A,B,C,D); Plate 36, 37)

Prevalence: The maximum prevalence of cestode infection (1.00) was recorded in the hosts with alimentary canal weight ranging from 35-60 gm. and 111-135 gm. during winter, in 61-85 gm. during summer and rainy season.

The minimum prevalence (0.111) was recorded in the hosts with alimentary canal weight ranging from 111-135 gm. during summer.

Mean intensity: The maximum mean intensity of the cestode infection (42.42) during winter as recorded in the hosts with alimentary canal weight ranging from 86-110 gm.

The minimum mean intensity of the cestode infection (8.00) was recorded in the hosts with alimentary canal weight ranging from 111-135 gm.

Relative density: The maximum relative density of cestode infection (37.77) was recorded in the hosts with alimentary canal weight ranging from 35-60 gm. during winter.

The minimum relative density of cestode infection (0.888) was recorded in the hosts with alimentary canal weight ranging from 111-135 gm. during summer.

(c) Average monthwise variations (Table 30 (A,B,C,D) Plate 38,39,40,41)

Prevalence: In the hosts with alimentary canal weight ranging from 35-60 gm. the maximum prevalence (1.00) was recorded in the months of November, December, January, February, March, April, August, September and October whereas the minimum (0.666) in July. In the month of June no host of this alimentary canal weight range was examined.

In the alimentary canal weight range of 61-85 gm. the maximum prevalence (1.00) was recorded throughout the year except in the month of December where it was 0.666. In the hosts with alimentary canal weight ranging from 86-110 gm. the maximum prevalence (1.00) was recorded in the months of November, February, March, April, May, July, August and September, while minimum prevalence (0) was recorded in the months of June and October. In the hosts with alimentary canal weight range of 111-135 gm. the maximum prevalence (1.00) was recorded in the months of November, December, January, February, March, July, August and September, while minimum (0) was recorded in the months of April, May, June and October.

Mean intensity: In the hosts with alimentary canal weight ranging from 35-60 gm. the maximum mean intensity (48.5) was recorded in July and minimum (16.00) in May. In rest of the months, it ranges from 16.5 to 44.0 except in June when the hosts of this alimentary canal weight range could not be examined. In the alimentary canal weight ranging from 61-85 gm. the maximum mean intensity (54.0) was recorded in November and minimum (8.00) in June. In rest of the months it ranges from 10.0 to 47.0. In the hosts with alimentary canal weight ranging from 86-110 gm. the maximum mean intensity (59.00) was in December and minimum (0) was

recorded in the months of June and October. In rest of the months it ranges from 3.00 to 34.5. In the hosts with alimentary canal weight ranging from 111-135 gm. the maximum mean intensity (39.5) was in January and the minimum (0) was in the months of April, May, June and October. In rest of the months it ranges from 8.0 to 38.0.

Relative density: In the hosts with alimentary canal weight ranging from 35-60 gm. the maximum relative density (44.0) was recorded in January and minimum (12.00) in May. In other months it ranges from 16.5 to 41.0 except in June when the hosts of this alimentary canal weight range could not be examined. In the host with alimentary canal weight ranging from 61-85 gm. the maximum relative density (54.0) was recorded in November and minimum (8.00) in June. In rest of the months it ranges from 10.0 to 36.0. In the hosts with alimentary canal weight ranging from 86-110 gm. the maximum relative density (50.00) was recorded in the month of November and minimum (0) was in the months of June and October. In rest of the months it ranges from 3.00 to 36.33. In the hosts with alimentary canal weight ranging from 111-135 gm. the maximum relative density (39.5) was recorded in January and minimum (0) in the months of April, May, June and October. In rest of the months it ranges from 8.00 to 38.00.

III) Cestode infection in relation to the sex of the host:

(a) Average annual variations (Table 31, Plate 42)

Prevalence: The prevalence of cestode infection was 0.687 in males and 0.94 in females.

Mean intensity: The mean intensity of cestode infection was 18.57 in males and 32.8 in females.

Relative density: The relative density of cestode infection was 12.77 in males and 30.84 in females.

(b) Average seasonal variations (Table 32 (A,B); Plate 43)

Prevalence

In males: The maximum prevalence (0.833) was recorded in rainy season while the minimum (0.357) in summer.

In females: The maximum prevalence (1.00) was recorded in winter while the minimum (0.875) in summer.

Mean intensity

In males: The maximum mean intensity (19.92) was recorded in winter while minimum (15.2) in summer.

In females: The maximum mean intensity (50.35) was recorded in winter while minimum (20.64) in summer.

Relative density:

In males: The maximum relative density (16.18) was recorded in winter season while the minimum (5.42) in summer.

In females: The maximum relative density (50.35) was recorded during winter season while the minimum (18.06) in summer.

(c) Average monthwise variations (Table 33 (A,B); Plate 44, 45)

In males:

Prevalence: The maximum prevalence (1.00) was recorded in the months of November, February, March, August and September while minimum (0) was recorded in the months of May and June. In rest of the months it ranges from 0.5 to 0.8.

Mean intensity: The maximum mean intensity (26.33) was recorded in the month of December while minimum (0) in the months of May and June. In rest of the months it ranges from 3.00 to 24.00.

Relative density: The maximum relative density (24.00) was recorded in the month of November while the minimum (0) in May and June. In rest of the months it ranges from 1.5 to 19.33.

In females:

Prevalence: The maximum prevalence (1.00) was recorded in the months of November, December, January, February, March, April, May, July, August and September while minimum (0.333) was in the month of June.

Mean intensity: The maximum mean intensity (81.00) was recorded in January while minimum (8.00) in June. In rest of the months it ranges from 12.2 to 55.00.

Relative density: The maximum relative density (81.00) was recorded in the month of January while minimum (2.66) in June. In rest of the months it ranges from 12.0 to 55.00.

Table 22

Average annual variations in the Prevalence, Mean intensity and Relative density of Helminth infection in domestic fowls

Number of hosts examined		98
Number of hosts infected with	Cestode	80
	Nematode	39
	Trematode	01
Prevalence of	Cestode	0.816
	Nematode	0.397
	Trematode	0.0102
Number of worms obtained	Cestode	2155
	Nematode	227
	Trematode	05
Mean intensity	Cestode	26.93
	Nematode	5.82
	Trematode	5.00
Relative density	Cestode	21.98
	Nematode	2.316
	Trematode	0.051

Table 23

Average seasonal variations in the Prevalence, Mean intensity and Relative density of cestode infection in fowls

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	33	30	0.909	1115	37.16	33.78
Summer	30	19	0.633	365	19.21	12.16
Rainy	35	31	0.885	675	21.77	19.28

Table 24

Average monthwise variations in the Prevalence, Mean intensity and Relative density of cestode infection in fowls

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	9	9	1.00	340	37.77	37.77
Dec. (85 & 86)	9	7	0.777	290	41.42	32.22
Jan. (86 & 87)	8	7	0.875	297	42.42	37.12
Feb. (86 & 87)	7	7	1.00	188	26.85	26.85
Mar. (86 & 87)	8	8	1.00	194	24.25	24.25
April (86 & 87)	6	5	0.833	102	20.40	17.00
May (86 & 87)	7	5	0.714	61	12.20	8.71
June (86 & 87)	9	1	0.111	8	8.00	0.88
July (86 & 87)	10	9	0.9	256	28.44	25.60
Aug. (86 & 87)	7	7	1.00	161	23.00	23.00
Sept. (86 & 87)	9	9	1.00	166	18.44	18.44
Oct. (86 & 87)	9	6	0.666	92	15.33	10.22

Table 25

Average annual variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the body weight of the host

Range of the body weight (gm.)	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
750-1050	12	11	0.916	437	39.72	36.41
1051-1350	34	30	0.882	786	26.20	23.11
1351-1650	28	24	0.857	502	20.91	17.92
1651-1950	18	12	0.666	312	26.00	17.33
1951-2250	6	3	0.500	118	39.33	19.66

Table 26 (A,B,C,D,E)

Average seasonal variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the body weight of the host

Table 26A

Body weight of the host - 750-1050 gm.

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	5	5	1.00	245	49.00	49.00
Summer	2	2	1.00	55	27.50	27.50
Rainy	5	4	0.80	137	34.25	27.40

Table 26B

Body weight of the host - 1051-1350 gm

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	9	8	0.888	315	39.37	35.00
Summer	9	8	0.888	156	19.50	17.33
Rainy	16	14	0.875	315	22.50	19.68

Table 26C

Body weight of the host - 1351-1650 gm.

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	12	11	0.916	284	25.81	23.66
Summer	10	7	0.700	117	16.71	11.70
Rainy	6	6	1.000	101	16.83	16.83

Table 26D

Body weight of the host - 1651-1950 gm.

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	5	5	1.00	203	40.60	40.60
Summer	7	1	0.142	8	8.00	1.14
Rainy	6	6	1.00	101	16.83	16.83

Table 26E

Body weight of the host - 1951-2250 gms.

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	2	1	0.5	68	68.00	34.00
Summer	2	1	0.5	29	29.00	14.50
Rainy	2	1	0.5	21	21.00	10.50

Table 27 (A,B,C,D,E)

Average monthwise variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the body weight of the host

Table 27A

Body weight of the host - 750-1050 gm.

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	1	1	1.00	78	78.00	78.00
Dec. (85 & 86)	1	1	1.00	40	40.00	40.00
Jan. (86 & 87)	2	2	1.00	120	60.00	60.00
Feb. (86 & 87)	1	1	1.00	7	7.00	7.00
March (86 & 87)	1	1	1.00	29	29.00	29.00
April (86 & 87)	1	1	1.00	26	26.00	26.00
May (86 & 87)	-	-	-	-	-	-
June (86 & 87)	-	-	-	-	-	-
July (86 & 87)	2	1	0.5	49	49.00	24.50
Aug. (86 & 87)	2	2	1.00	62	31.00	31.00
Sept. (86 & 87)	1	1	1.00	26	26.00	26.00
Oct. (86 & 87)	-	-	-	-	-	-

Table 27B

Body weight of the host - 1051-1350 gms

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	3	3	1.00	115	38.33	38.33
Dec. (85 & 86)	2	1	0.50	57	57.00	28.50
Jan. (86 & 87)	2	2	1.00	87	43.5	43.50
Feb. (86 & 87)	2	2	1.00	56	28.00	28.00
March (86 & 87)	2	2	1.00	52	26.00	26.00
April (86 & 87)	2	2	1.00	49	24.5	24.50
May (86 & 87)	4	4	1.00	55	13.75	13.75
June (86 & 87)	1	0	0	0	0	0
July (86 & 87)	6	6	1.00	178	29.66	29.66
Aug. (86 & 87)	4	4	1.00	86	21.50	21.50
Sept. (86 & 87)	4	4	1.00	51	12.75	12.75
Oct. (86 & 87)	2	0	0	0	0	0

Table 27C

Body weight of the host - 1351-1650 gm.

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	4	4	1.00	125	31.25	31.25
Dec. (85 & 86)	3	3	1.00	67	22.33	22.33
Jan. (86 & 87)	3	2	0.666	62	31.00	20.66
Feb. (86 & 87)	2	2	1.00	30	15.00	15.00
March (86 & 87)	4	4	1.00	84	21.00	21.00
April (86 & 87)	2	2	1.00	27	13.50	13.50
May (86 & 87)	3	1	0.333	6	6.00	2.00
June (86 & 87)	1	0	0	0	0	0
July (86 & 87)	1	1	1.00	10	10.00	10.00
Aug. (86 & 87)	-	-	-	-	-	-
Sept. (86 & 87)	1	1	1.00	36	36.00	36.00
Oct. (86 & 87)	4	4	1.00	55	13.75	13.75

Table 27D

Body weight of the host - 1651-1950 gm.

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean Intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	1	1	1.00	22	22.00	22.00
Dec. (85 & 86)	2	2	1.00	126	63.00	63.00
Jan. (86 & 87)	1	1	1.00	28	28.00	28.00
Feb. (86 & 87)	1	1	1.00	27	27.00	27.00
March(86 & 87)	-	-	-	-	-	-
April(86 & 87)	-	-	-	-	-	-
May (86 & 87)	-	-	-	-	-	-
June (86 & 87)	7	1	0.142	8	8.00	1.14
July (86 & 87)	1	1	1.00	19	19.00	19.00
Aug. (86 & 87)	1	1	1.00	13	13.00	13.00
Sept.(86 & 87)	3	3	1.00	53	17.66	17.66
Oct. (86 & 87)	1	1	1.00	16	16.00	16.00

Table 27E

Body weight of the host - 1951-2250 gm.

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	-	-	-	-	-	-
Dec. (85 & 86)	1	0	0	0	0	0
Jan. (86 & 87)	-	-	-	-	-	-
Feb. (86 & 87)	1	1	1.00	68	68.00	68.00
March (86 & 87)	1	1	1.00	29	29.00	29.00
April (86 & 87)	1	0	0	0	0	0
May (86 & 87)	-	-	-	-	-	-
June (86 & 87)	-	-	-	-	-	-
July (86 & 87)	-	-	-	-	-	-
Aug. (86 & 87)	-	-	-	-	-	-
Sept. (86 & 87)	-	-	-	-	-	-
Oct. (86 & 87)	2	1	0.5	21	21.00	10.50

Table 28

Average annual variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the weight of alimentary canal of the host

Weight of alimentary canal (gm.)	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
35-60	27	25	0.925	790	31.60	29.25
61-85	21	20	0.952	553	27.65	26.33
86-110	24	19	0.791	471	24.78	19.62
111-135	26	16	0.615	341	21.31	13.11

Table 29 (A,B,C,D)

Average seasonal variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the weight of alimentary canal of the host

Table 29A

Weight of alimentary canal of the host - 35-60 gm.

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	9	9	1.00	340	37.77	37.77
Summer	8	7	0.875	194	27.71	24.25
Rainy	10	9	0.90	256	28.44	25.60

Table 29B

Weight of alimentary canal of the host - 61-85 gm.

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	8	7	0.875	290	41.42	36.25
Summer	6	6	1.00	102	17.00	17.00
Rainy	7	7	1.00	161	23.00	23.00

Table 29C

Weight of alimentary canal of the host - 86-110 gm.

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	9	7	0.777	297	42.42	33.00
Summer	7	5	0.714	61	12.20	8.71
Rainy	8	7	0.875	113	16.14	14.12

Table 29D

Weight of the alimentary canal of the host - 111-135 gm.

Season	Number of hosts Examined	Number of hosts Infected	Prevalence	Number of cestodes obtained	Mean intensity	Relative density
Winter	7	7	1.00	188	26.85	26.85
Summer	9	1	0.111	8	8.00	0.888
Rainy	10	8	0.80	145	18.12	14.50

Table 30 (A,B,C,D)

Average monthwise variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the weight of alimentary canal of the host

Table 30A

Weight of alimentary canal of the host - 35–60 gm

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	2	2	1.00	71	35.50	35.50
Dec. (85 & 86)	3	3	1.00	99	33.00	33.00
Jan. (86 & 87)	2	2	1.00	88	44.00	44.00
Feb. (86 & 87)	2	2	1.00	82	41.00	41.00
March (86 & 87)	2	2	1.00	70	35.00	35.00
April (86 & 87)	2	2	1.00	76	38.00	38.00
May (86 & 87)	4	3	0.75	48	16.00	12.00
June (86 & 87)	-	-	-	-	-	-
July (86 & 87)	3	2	0.666	97	48.50	32.33
Aug. (86 & 87)	2	2	1.00	60	30.00	30.00
Sept. (86 & 87)	1	1	1.00	33	33.00	33.00
Oct. (86 & 87)	4	4	1.00	66	16.50	16.50

Table 30B

Weight of alimentary canal of the host - 61-85 gm.

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	2	2	1.00	108	54.00	54.00
Dec. (85 & 86)	3	2	0.666	94	47.00	31.33
Jan. (86 & 87)	1	1	1.00	21	21.00	21.00
Feb. (86 & 87)	2	2	1.00	67	33.50	33.50
March (86 & 87)	3	3	1.00	68	22.66	22.66
April (86 & 87)	1	1	1.00	16	16.00	16.00
May (86 & 87)	1	1	1.00	10	10.00	10.00
June (86 & 87)	1	1	1.00	8	8.00	8.00
July (86 & 87)	1	1	1.00	36	36.00	36.00
Aug. (86 & 87)	2	2	1.00	48	24.00	24.00
Sept. (86 & 87)	2	2	1.00	51	25.50	25.50
Oct. (86 & 87)	2	2	1.00	26	13.00	13.00

Table 30C

Weight of alimentary canal of the host - 86-110 gm

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	2	2	1.00	100	50.00	50.00
Dec. (85 & 86)	2	1	0.50	59	59.00	29.50
Jan. (86 & 87)	3	2	0.666	109	54.50	36.33
Feb. (86 & 87)	2	2	1.00	29	14.50	14.50
March (86 & 87)	2	2	1.00	48	24.00	24.00
April (86 & 87)	2	2	1.00	10	5.00	5.00
May (86 & 87)	1	1	1.00	3	3.00	3.00
June (86 & 87)	2	0	0	0	0	0
July (86 & 87)	3	3	1.00	93	31.00	31.00
Aug. (86 & 87)	1	1	1.00	8	8.00	8.00
Sept. (86 & 87)	3	3	1.00	12	4.00	4.00
Oct. (86 & 87)	1	0	0	0	0	0

Table 30D

Weight of alimentary canal of the host - 111-135 gm

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	3	3	1.00	61	20.33	20.33
Dec. (85 & 86)	1	1	1.00	38	38.00	38.00
Jan. (86 & 87)	2	2	1.00	79	39.50	39.50
Feb. (86 & 87)	1	1	1.00	10	10.00	10.00
March (86 & 87)	1	1	1.00	8	8.00	8.00
April (86 & 87)	1	0	0	0	0	0
May (86 & 87)	1	0	0	0	0	0
June (86 & 87)	6	0	0	0	0	0
July (86 & 87)	3	3	1.00	30	10.00	10.00
Aug. (86 & 87)	2	2	1.00	45	22.50	22.50
Sept. (86 & 87)	3	3	1.00	70	23.33	23.33
Oct. (86 & 87)	2	0	0	0	0	0

Table 31

Average annual variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the sex of the host

Sex	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Males	48	33	0.687	613	18.57	12.77
Females	50	47	0.940	1542	32.80	30.84

Table 32 (A,B)

Average seasonal variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the sex of the host

Table 32A

Males

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	16	13	0.812	259	19.92	16.18
Summer	14	5	0.357	76	15.20	5.42
Rainy	18	15	0.833	278	18.53	15.44

Table 32B

Females

Season	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Winter	17	17	1.00	856	50.35	50.35
Summer	16	14	0.875	289	20.64	18.06
Rainy	17	16	0.941	397	24.81	23.35

Table 33 (A,B)

Average monthwise variations in the Prevalence, Mean intensity and Relative density of cestode infection in relation to the sex of the host

Table 33A

Males

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	5	5	1.00	120	24.00	24.00
Dec. (85 & 86)	5	3	0.60	79	26.33	15.80
Jan. (86 & 87)	5	4	0.80	54	13.50	10.80
Feb. (86 & 87)	1	1	1.00	6	6.00	6.00
March (86 & 87)	4	4	1.00	73	18.25	18.25
April (86 & 87)	2	1	0.50	3	3.00	1.50
May (86 & 87)	2	0	0	0	0	0
June (86 & 87)	6	0	0	0	0	0
July (86 & 87)	5	4	0.80	93	23.25	18.60
Aug. (86 & 87)	3	3	1.00	58	19.33	19.33
Sept. (86 & 87)	5	5	1.00	83	16.60	16.60
Oct. (86 & 87)	5	3	0.60	44	14.66	8.80

Table 33B

Females

Month/year	Number of hosts		Prevalence	Number of cestodes obtained	Mean intensity	Relative density
	Examined	Infected				
Nov. (85 & 86)	4	4	1.00	220	55.00	55.00
Dec. (85 & 86)	4	4	1.00	211	52.75	52.75
Jan. (86 & 87)	3	3	1.00	243	81.00	81.00
Feb. (86 & 87)	6	6	1.00	182	30.33	30.33
March (86 & 87)	4	4	1.00	121	30.25	30.25
April (86 & 87)	4	4	1.00	99	24.75	24.75
May (86 & 87)	5	5	1.00	61	12.20	12.20
June (86 & 87)	3	1	0.333	8	8.00	2.66
July (86 & 87)	5	5	1.00	163	32.60	32.60
Aug. (86 & 87)	4	4	1.00	103	25.75	25.75
Sept. (86 & 87)	4	4	1.00	83	20.75	20.75
Oct. (86 & 87)	4	3	0.75	48	16.00	12.00

DISCUSSION AND CONCLUSIONS

Domestic fowls, Gallus gallus (Linnaeus) are generally infected with all the three kinds of helminth parasites i.e. cestodes, trematodes and nematodes. Kinsella (1966) reported the dominance of nematodes over trematodes and cestodes in the Florida. Lees (1962) also reported the dominance of nematodes over the trematode and cestode infection in frogs. Srivastava (1987) reported the dominance of cestode infection over the nematode and trematode infection in doves. During the course of present investigation in fowls, however, it was noted that cestodes constitute the dominant group of helminths, in their Prevalence, Mean intensity and Relative density over the nematode and trematode infections (Table 22, Plate 24).

The prevalence of cestodes in domestic fowls has been found to be highest during winter (Table 23, Plate 25) in the present observations. This phenomenon may be related to the relative incidence of the intermediate hosts of these parasites. It is well known that in the dry tropical summer terrestrial arthropods tend to be greatly reduced. They die or go in hiding and reappear after rains set in with the temperature going down and humidity increasing. The population of these forms e.g. grass hoppers, ticks

and mites etc. is built up speedily and reaches the peak in late August, September or October. One may naturally expect an increase in the helminth infection in association with or following an increase in the incidence of the intermediate hosts. Thus in case of the cestodes of domestic fowl there is a remarkable increase in prevalence, mean intensity and relative density in winter following the buildup of the intermediate host population in August to October. Lees (1962) also reported the highest incidence of helminths in autumn in United Kingdom, where insects and other arthropods reappear after winter diapause with the maximum in spring i.e. helminth abundance follows intermediate host abundance. Kinsella (1966) reported parasitic prevalence during summer and rainy season and believes that the greater occurrence of arthropods in this season is the sole reason for their prevalence. From the available reports thus a strong indication exists that there is a definite correlation between the occurrence of the parasites and their intermediate hosts during the year.

The prevalence of cestodes shows a decline in summer (Table 23, Plate 25) to the extent that in June it comes to 0.111. This again seems to be related to the minimum occurrence of intermediate host during summer. The highest mean intensity of cestode infection was recorded in winter (Table 23, Plate 25). Apparently new infection is

acquired in rainy season and since the hosts may not possess immunity, the mean intensity rises to a very great extent in late winter. Again as infection continues, surviving hosts develop some immunity and hence mean intensity of cestodes infection decreases in summer. The mean intensity shows a marked fall in summer specially in June (Table 24, Plate 26). This corresponds to the fact that prevalence is directly proportional to the mean intensity of infection. Lees (1962) and Mazuromovich (1951) suggest lack of adequate food as the reason for their decline. A similar explanation can also be proposed for the relative density of cestodes which was higher in winter season and lowest in summer (Table 23, Plate 25).

Cestode infection and host body weight:

The body weight of the bird host is related to a number of factors like age, health and availability of food. The present observation indicates that the birds with lesser body weight show greater prevalence, mean intensity and relative density of cestodes (Table 25, Plate 27). This finding is in agreement to that of Lees (1962) in frogs. He found that young hosts are more frequently and more heavily parasitized by Polystomum integrimum. This may also be taken to indicate that younger birds and those with poorer health conditions are liable to get the infection as they do not possess immunity against the parasites.

Cestodes infection and alimentary canal weight of the host:

In the present observations it is evident that the prevalence, mean intensity and relative density are highest in birds with lesser weight of alimentary canal and lowest in birds with greater weight of their alimentary canal. The weight of alimentary canal is directly proportional to the size of alimentary canal, which is minimum in young birds and maximum in fully grown adults. The present observations clearly indicate that more of prevalence, mean intensity and relative density of cestodes in younger birds corresponds to the lesser immunity developed against the parasites and the occurrence of lowest prevalence, mean intensity and relative density in adults corresponds to the occurrence of maximum immunity against the cestode parasites.

Cestode infection and sex of the host:

In the present observations female birds show higher annual prevalence, mean intensity and relative density of cestode infection than the male birds (Table 31, Plate 42), Mazuromovich (1951) and Markov and Rogoza (1955) have pointed out that the heavier infestation of helminth parasites occurs in the males. Lees (1962) also pointed out that incidence of helminths was higher in male frogs than the females. But Kennedy (1969) while working on the incidence of *Caryophylleus laticeps* in the dace, *Leuciscus leuciscus* has reported that

the degree of infection is higher in females than in males. The present observations support Kennedy's interpretations that females are possibly less resistant to the helminth infection because of the greater stress placed on them due to the frequent changes in their hormonal balance. Thomas (1964) has attributed this fact to the differences in the physiological resistance of males and females.

To sum up, the present observations show that in domestic fowls *Gallus gallus* (Linnaeus):

(a) Cestodes constitute the dominant group of parasites in comparison to other helminth group viz., nematode and trematode.

(b) The prevalence, mean intensity and relative density of cestodes are highest during winter and lowest in summer.

(c) Summer appears to be the most unsuitable period for the prevalence, mean intensity and relative density of cestodes. This phenomenon seems to be related to the lower incidence and lower abundance of arthropod intermediate hosts during this period.

(d) Young birds are more frequently and more heavily parasitized by the cestodes possibly because they do not possess immunity against the cestode infection.

(e) Female birds show higher prevalence, mean intensity and relative density of cestode infection than the males. This phenomenon may be related to reduced resistance in females caused by the greater stress placed on them due to the frequent changes in their hormonal balance.

PART- D

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EXPLANATION OF THE PLATES

Plate 1. *Killigrewia srivastavai* n.sp.

Fig. 1 Scolex with neck (10 x 10)

Fig. 2 Mature proglottid (5 x 10)

Fig. 3 Gravid proglottid (5 x 10)

Fig. 4 Egg (10 x 45)

Plate 2. *Doublesetina fotedari* n.g., n.sp.

Fig. 1 Scolex (5 x 10)

Fig. 2 Mature proglottid (5 x 10)

Fig. 3 Gravid proglottid (5 x 10)

Fig. 4 Egg capsule (10 x 45)

Plate 3. *Cotugnia davali* Singh, 1952

Fig. 1 Scolex with neck (5 x 10)

Fig. 2 Rostellar hooks (10 x 45)

Fig. 3 Mature proglottid (5 x 10)

Fig. 4 A portion of gravid proglottid (5 x 10)

Fig. 5 Egg capsule (10 x 45)

Plate 4. *Davainea hanumanthai* n.sp.

Fig. 1 Scolex (5 x 10)

Fig. 2 Rostellar hooks (10 x 45)

Fig. 3 Mature proglottid (5 x 10)

Fig. 4 Gravid proglottid (5 x 10)

Fig. 5 Egg capsule (10 x 45)

Plate 5. Raillietina (Fuhrmannetta) talourensis n.sp.

Fig. 1 Scolex with neck (5 x 10)

Fig. 2 Rostellar hooks (10 x 45)

Fig. 3 Mature proglottid (5 x 10)

Fig. 4 Gravid proglottid (5 x 10)

Fig. 5 Egg (10 x 45)

Plate 6. Raillietina (Paroniella) mothensis n.sp.

Fig. 1 Scolex with neck (10 x 10)

Fig. 2 Rostellar hooks (10 x 45)

Fig. 3 Mature proglottid (5 x 10)

Fig. 4 Gravid proglottid (5 x 10)

Fig. 5 Egg capsule (10 x 45)

Plate 7. Amoebotaenia agrawali n.sp.

Fig. 1 Scolex (10 x 10)

Fig. 2 Rostellar hook (10 x 45)

Fig. 3 Mature proglottid (5 x 45)

Fig. 4 Gravid proglottid (10 x 10)

Fig. 5 Egg (10 x 45)

Plate 8. Amoebotaenia capoori n.sp.

Fig. 1 Scolex (10 x 10)

Fig. 2 Rostellar hook (10 x 45)

Fig. 3 Mature proglottid (10 x 10)

Fig. 4 Gravid proglottid (5 x 10)

Fig. 5 Egg (10 x 45)

Plate 9. <u>Clelandia</u> (<u>Podicollis</u>) <u>sawadai</u> n.subg.; n.sp.

Fig. 1 Scolex (5 x 10)

Fig. 2 Rostellar hook (10 x 45)

Fig. 3 Mature proglottids (10 x 10)

Fig. 4 Gravid proglottid (10 x 10)

Fig. 5 Egg (10 x 45)

Plate 10. <u>Neoliga affinis</u> n.sp.

Fig. 1 Scolex (10 x 10)

Fig. 2 Rostellar hook (Anterior row) (10 x 45)

Fig. 3 Rostellar hook (Posterior row) (10 x 45)

Fig. 4 Mature proglottid (10 x 10)

Fig. 5 Gravid proglottid (5 x 10)

Fig. 6 Egg (10 x 45)

Plate 11. <u>Anoncotaenia caudatai</u> n.sp.

Fig. 1 Scolex with neck (5 x 10)

Fig. 2 Mature proglottids (10 x 10)

Fig. 3 Gravid proglottid (10 x 10)

Plate 12. <u>Neyraia dayali</u> n.sp.

Fig. 1 Scolex with neck (5 x 10)

Fig. 2 Rostellar hooks (10 x 45)

Fig. 3 Mature proglottid (5 x 45)

Fig. 4 Gravid proglottid (5 x 10)

Fig. 5 Egg (10 x 45)

Plate 13. <u>Armadoskrjabinia</u> <u>nyrocai</u> n.sp.

Fig. 1 Scolex with neck (10 x 10)
Fig. 2 Rostellar hook (10 x 45)
Fig. 3 Mature proglottid (10 x 10)
Fig. 4 Gravid proglottids (5 x 10)
Fig. 5 Egg (10 x 45)

Plate 14. <u>Decacanthus</u> <u>bundelensis</u> n.sp.

Fig. 1 Scolex with neck (10 x 10)
Fig. 2 Rostellar hook (10 x 100)
Fig. 3 Mature proglottid (10 x 10)
Fig. 4 Gravid proglottids (10 x 10)
Fig. 5 Egg (10 x 45)

Plate 15. <u>Drepanidotaenia</u> <u>pandei</u> n.sp.

Fig. 1 Scolex with neck (10 x 10)
Fig. 2 Rostellar hook (10 x 45)
Fig. 3 Mature proglottid (5 x 45)
Fig. 4 Gravid proglottid (5 x 45)
Fig. 5 Egg (10 x 45)

Plate 16. <u>Mayhewia</u> <u>chauhani</u> n.sp.

Fig. 1 Scolex with neck (5 x 45)
Fig. 2 Rostellar hook (10 x 45)
Fig. 3 Mature proglottid (5 x 45)
Fig. 4 Gravid proglottid (5 x 10)
Fig. 5 Egg (10 x 45)

Plate 17. Mayhewia levinei Tandon and Singh, 1963

Fig. 1 Scolex with neck (5 x 45)

Fig. 2 Rostellar hook (10 x 45)

Fig. 3 Mature proglottid (5 x 10)

Fig. 4 Gravid proglottid (5 x 10)

Fig. 5 Egg (10 x 45)

Plate 18. Proterandria jhansiensis n.g., n.sp.

Fig. 1 Scolex (5 x 10)

Fig. 2 Rostellar hook (10 x 45)

Fig. 3 Anterior mature proglottid (5 x 10)

Fig. 4 Posterior mature proglottid (5 x 10)

Fig. 5 A sagittal section of mature proglottid (5 x 10)

Fig. 6 Gravid proglottid (5 x 10)

Fig. 7 Egg (10 x 45)

Plate 19. Dioecocestus indica n.sp. (Male)

Fig. 1 Scolex (5 x 10)

Fig. 2 Rostellar hook (5 x 45)

Fig. 3 Mature proglottid (5 x 10)

Fig. 4 A sagittal section of terminal genital duct (10 x 1

Plate 20. Dioecocestus indica n.sp. (Female)

Fig. 1 Scolex (5 x 10)

Fig. 2 Rostellar hook (5 x 45)

Fig. 3 Mature proglottid (5 x 10)

Fig. 4 A sagittal section of mature proglottid (5 x 10)

Fig. 5 A portion of gravid proglottid (5 x 10)

Fig. 6 Egg (10 x 45)

Plate 21. *Infula limosai* n.sp. (Male)

Fig. 1 Scolex with neck (5 x 10)

Fig. 2 Mature proglottid (5 x 10)

Fig. 3 Terminal genital duct (5 x 45)

Fig. 4 Cirrus (10 x 45)

Plate 22. *Infula limosai* n.sp. (Female)

Fig. 1 Scolex with neck (5 x 10)

Fig. 2 Mature proglottid (5 x 10)

Fig. 3 Anterior gravid proglottid (5 x 10)

Fig. 4 A portion of posterior gravid proglottid (5 x 10)

Fig. 5 Egg (10 x 10)

Plate 23. *Hymenocoelia liviana* n.sp.

Fig. 1 Scolex with neck (10 x 10)

Fig. 2 Rostellar hook (10 x 45)

Fig. 3 Mature male proglottid (10 x 10)

Fig. 4 Mature female proglottid (10 x 10)

Fig. 5 Gravid proglottid (10 x 10)

Fig. 6 Egg (10 x 45)

Plate 24. Variation in the helminth infection in fowls

Fig. 1 Average annual prevalence

Fig. 2 Average annual mean intensity

Fig. 3 Average annual relative density

Variations in prevalence, mean intensity and relative density of cestode infection in fowls

Plate 25

Fig. 1 Average seasonal prevalence

Fig. 2 Average seasonal mean intensity

Fig. 3 Average seasonal relative density

Plate 26

Fig. 1 Average monthwise prevalence

Fig. 2 Average monthwise mean intensity

Fig. 3 Average monthwise relative density

Variations in the prevalence, mean intensity and relative density of cestode infection in relation to the body weight of the fowls

Plate 27

Fig. 1 Average annual prevalence

Fig. 2 Average annual mean intensity

Fig. 3 Average relative density

Plate 28

Fig. 1 Average winter prevalence

Fig. 2 Average summer prevalence

Fig. 3 Average rainy prevalence

Plate 29

Fig. 1 Average winter mean intensity

Fig. 2 Average summer mean intensity

Fig. 3 Average rainy mean intensity

Fig. 4 Average winter relative density

Fig. 5 Average summer relative density

Fig. 6 Average rainy relative density

Plate 30

Fig. 1 Average monthwise prevalence in 750-1050 gm.

Fig. 2 Average monthwise mean intensity in 750-1050 gm.

Fig. 3 Average monthwise relative density in 750-1050 gm.

Plate 31

Fig. 1 Average monthwise prevalence in 1051-1350 gm.

Fig. 2 Average monthwise mean intensity in 1051-1350 gm.

Fig. 3 Average monthwise relative density in 1051-1350 gm.

Plate 32

Fig. 1 Average monthwise prevalence in 1351-1650 gm.

Fig. 2 Average monthwise mean intensity in 1351-1650 gm.

Fig. 3 Average monthwise relative density in 1351-1650 gm.

Plate 33

Fig. 1 Average monthwise prevalence in 1651-1950 gm.

Fig. 2 Average monthwise mean intensity in 1651-1950 gm.

Fig. 3 Average monthwise relative density in 1651-1950 gm.

Plate 34

Fig. 1 Average monthwise prevalence in 1951-2250 gm.

Fig. 2 Average monthwise mean intensity in 1951-2250 gm.

Fig. 3 Average monthwise relative density in 1951-2250 gm.

Variations in the prevalence, mean intensity and relative density of cestode infection in relation to the weight of alimentary canal of the host

Plate 35

Fig. 1 Average annual prevalence

Fig. 2 Average annual mean intensity

Fig. 3 Average annual relative density

Plate 36

Fig. 1 Average winter prevalence

Fig. 2 Average summer prevalence

Fig. 3 Average rainy prevalence

Plate 37

Fig. 1 Average winter mean intensity

Fig. 2 Average summer mean intensity

Fig. 3 Average rainy mean intensity

Fig. 4 Average winter relative density

Fig. 5 Average summer relative density

Fig. 6 Average rainy relative density

Plate 38

Fig. 1 Average monthwise prevalence in 35-60 gm.

Fig. 2 Average monthwise mean intensity in 35-60 gm.

Fig. 3 Average monthwise relative density in 35-60 gm.

Plate 39

Fig. 1 Average monthwise prevalence in 61-85 gm.

Fig. 2 Average monthwise mean intensity in 61-85 gm.

Fig. 3 Average monthwise relative density in 61-85 gm.

Plate 40

Fig. 1 Average monthwise prevalence in 86-110 gm.

Fig. 2 Average monthwise mean intensity in 86-110 gm.

Fig. 3 Average monthwise relative density in 86-110 gm.

Plate 41

Fig. 1 Average monthwise prevalence in 111-135 gm.

Fig. 2 Average monthwise mean intensity in 111-135 gm.

Fig. 3 Average monthwise relative density in 111-135 gm.

Variations in the prevalence, mean intensity and relative density of cestode infection in relation to the sex of the host

Plate 42

Fig. 1 Average annual prevalence

Fig. 2 Average annual mean intensity

Fig. 3 Average annual relative density

Plate 43

Fig. 1 Average seasonal prevalence

Fig. 2 Average seasonal mean intensity

Fig. 3 Average seasonal relative density

Plate 44

Fig. 1 Average monthwise prevalence in male

Fig. 2 Average monthwise mean intensity in male

Fig. 3 Average monthwise relative density in male

Plate 45

Fig. 1 Average monthwise prevalence in female

Fig. 2 Average monthwise mean intensity in female

Fig. 3 Average monthwise relative density in female

ABBREVIATIONS

AC	-	Accessory canal
AD	-	Armed duct
APR	-	April
AUG	-	August
B	-	Blade
C	-	Cirrus
COR	-	Copulatory region
CR	-	Conducting region
CP	-	Cirrus pouch
CS	-	Cirrus spine
DEC	-	December
DLEC	-	Dorsal longitudinal excretory canal
E	-	Egg
EC	-	Egg capsule
EH	-	Embryonic hook
EVS	-	External seminal vesicle
FEB	-	February
G	-	Guard
GA	-	Genital atrium
GP	-	Genital pore
H	-	Handle
IVS	-	Internal seminal vesicle
JAN	-	January
JUL	-	July
JUN	-	June

MAR - March

MD - Medial duct

MG - Mehlis gland

MW - Muscular wall

N - Neck

NOV - November

O - Ovary

OCT - October

ON - Onchosphere

OT - Ootype

PUO - Paruterine organ

R - Rostellum

RH - Rostellar hook

RS - Receptaculum seminis

ROS - Rostellar sac

S - Sucker

SC - Scolex

SEP - September

SM - Sphincter muscle

SS - Sucker spine

T - Testes

TEC - Transverse excretory canal

U - Uterus

V - Vagina

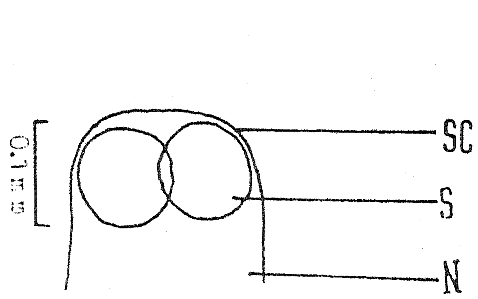
VD - Vas deferens

VG - Vitelline gland

VLEC - Ventral longitudinal excretory canal

WC - Wall of cirrus

PLATES



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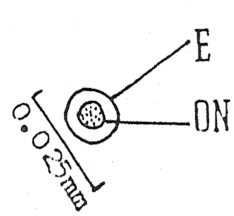

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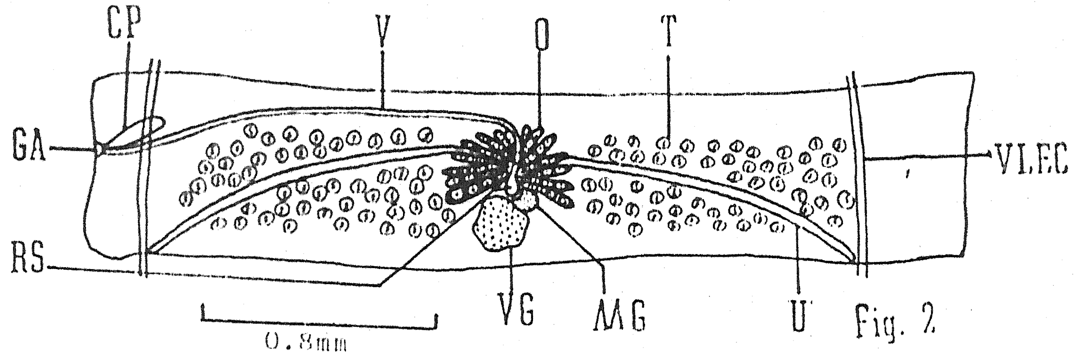

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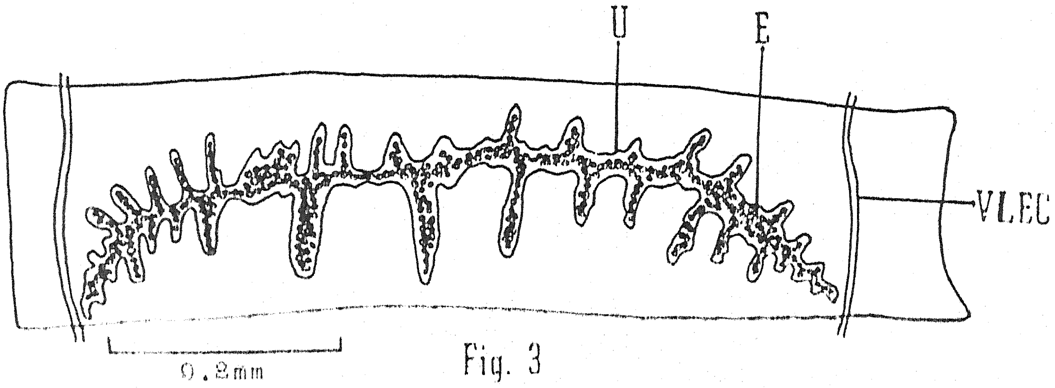
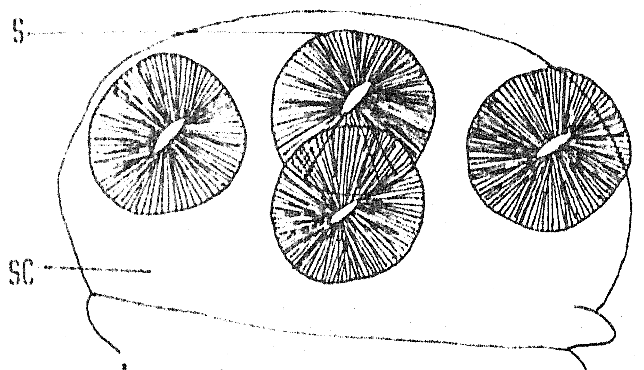


Fig. 3

PLATE I



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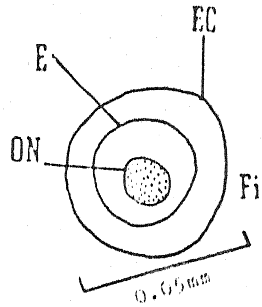

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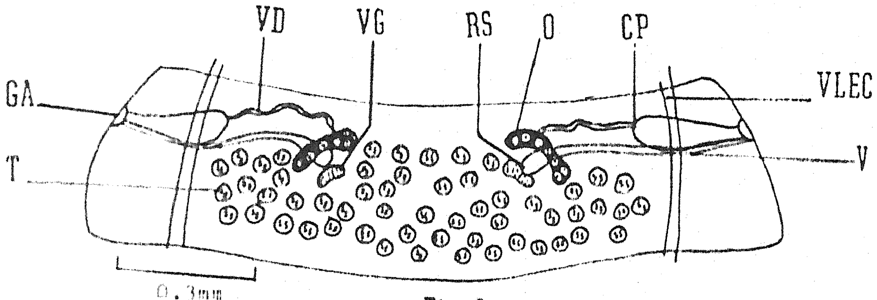

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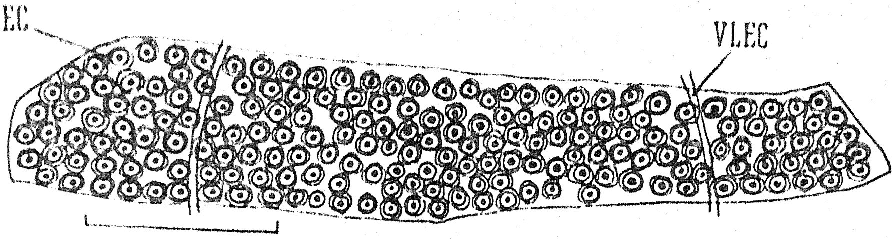
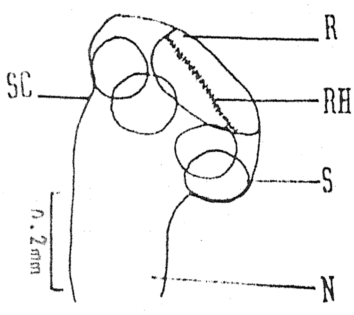


Fig. 3

PLATE 2



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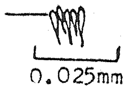

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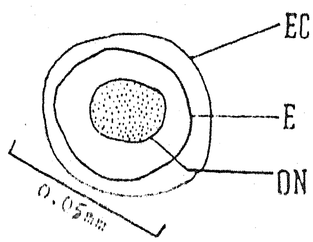

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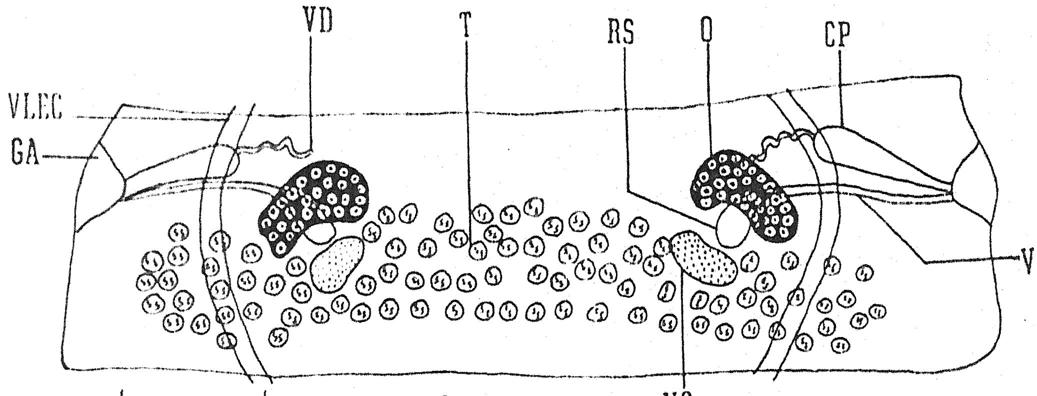


Fig. 3

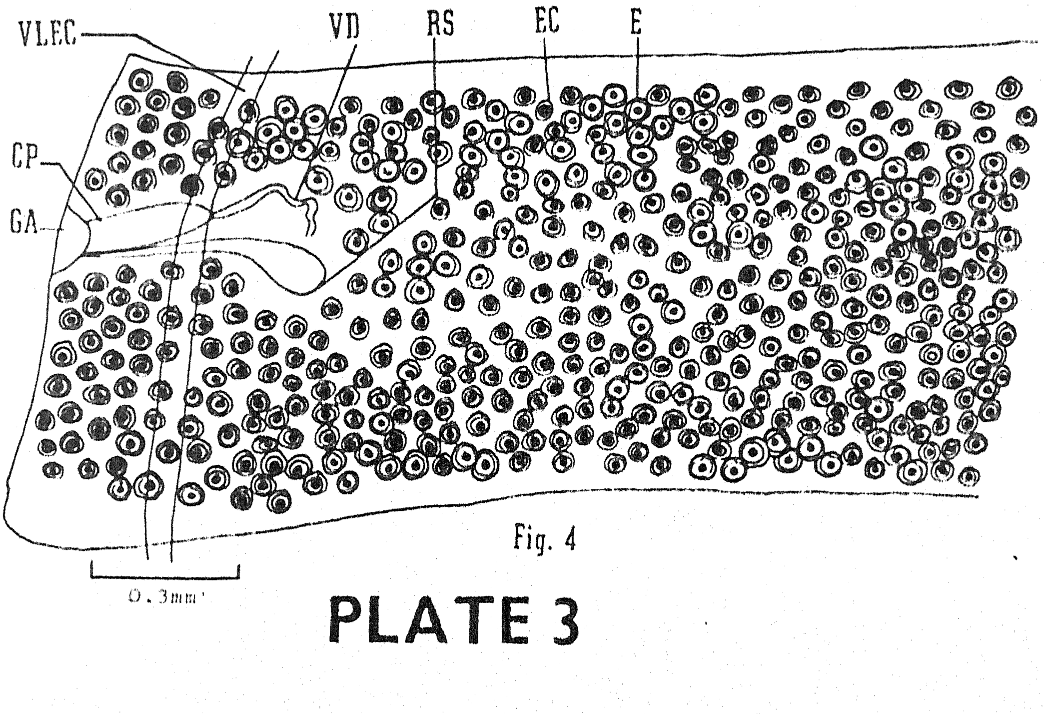
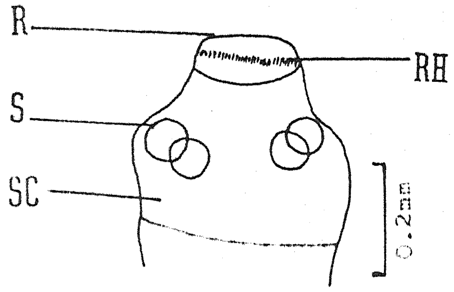


Fig. 4

PLATE 3



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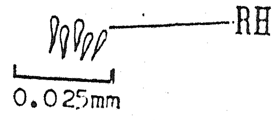

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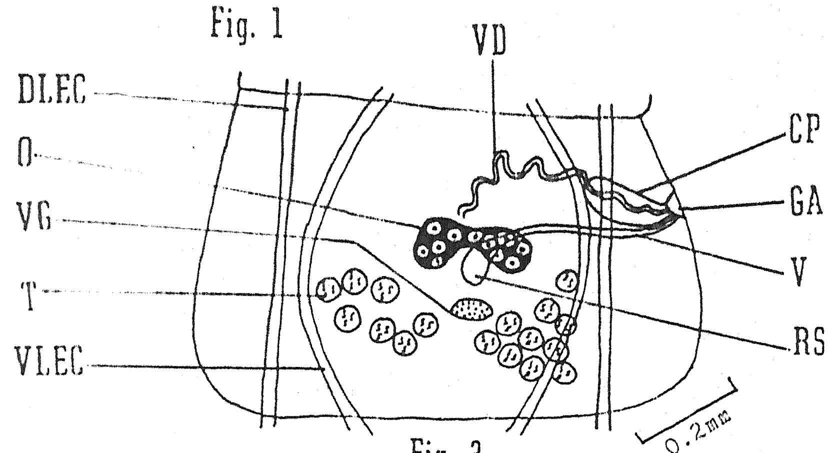

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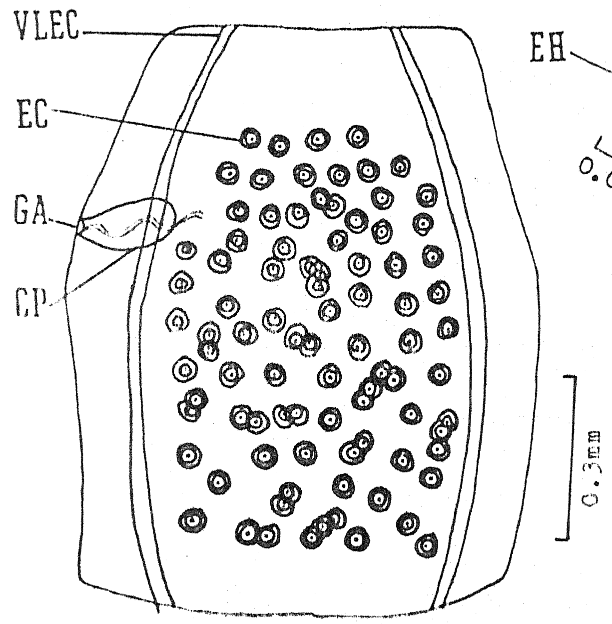

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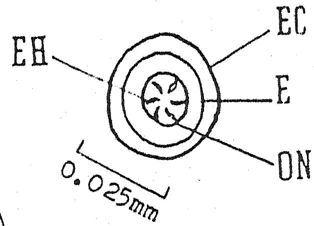

Fig. 5

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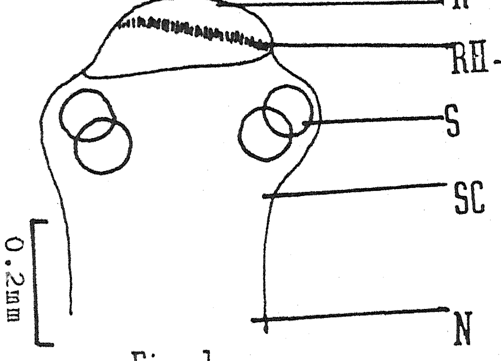

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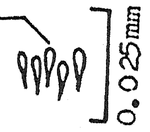

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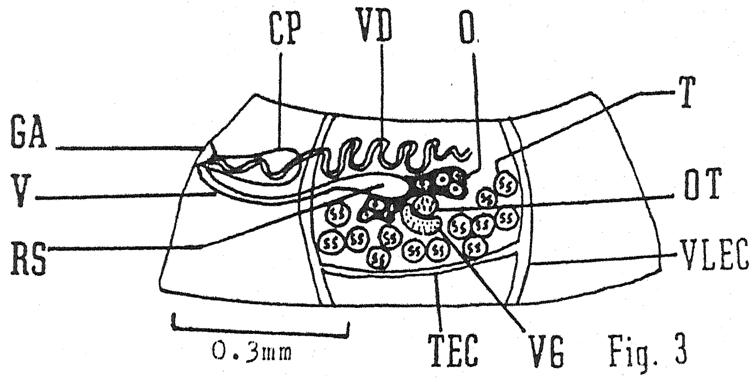

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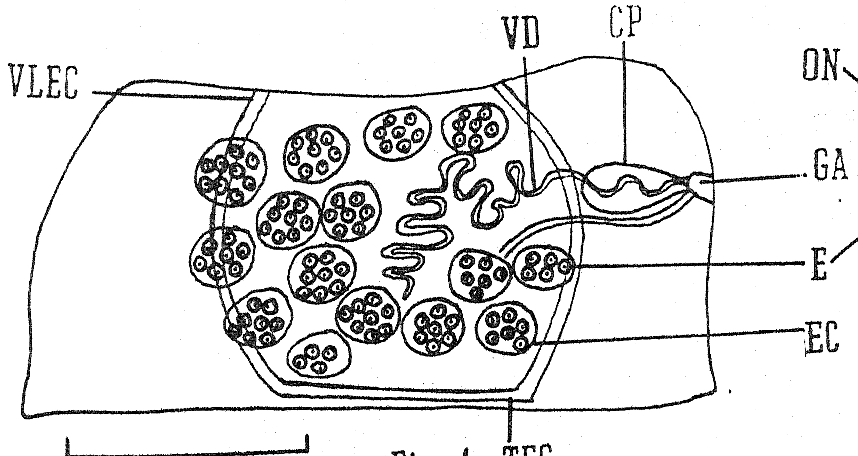

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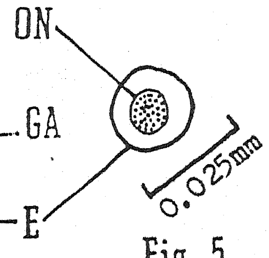
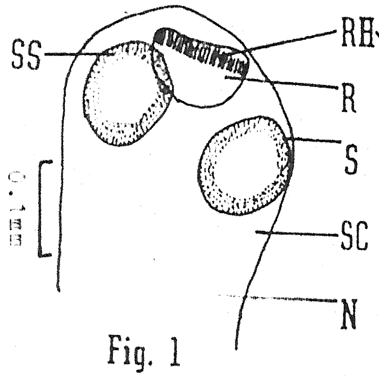


Fig. 5

PLATE 5



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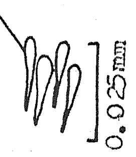

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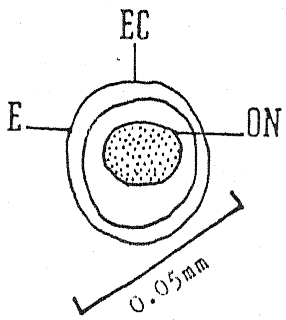

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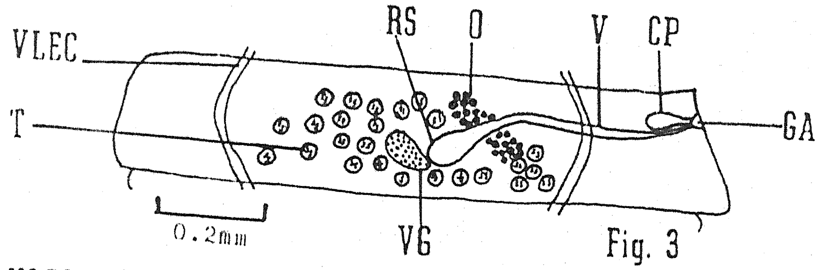

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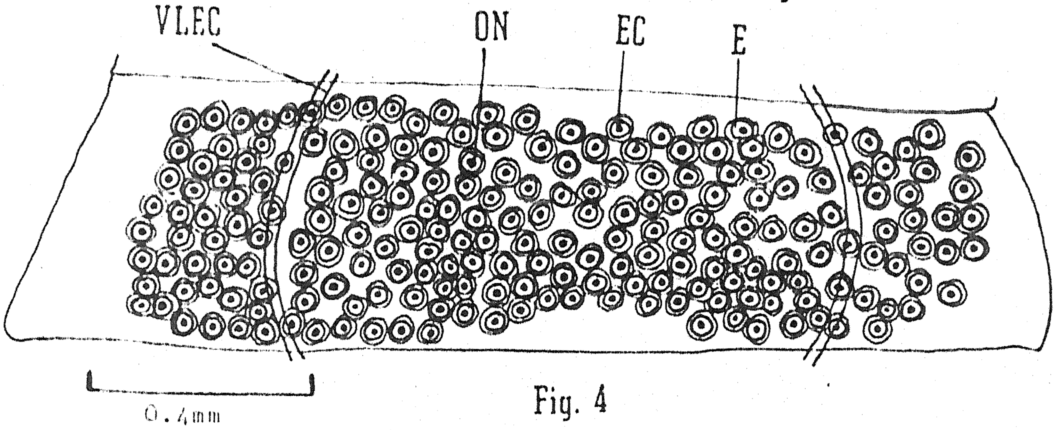

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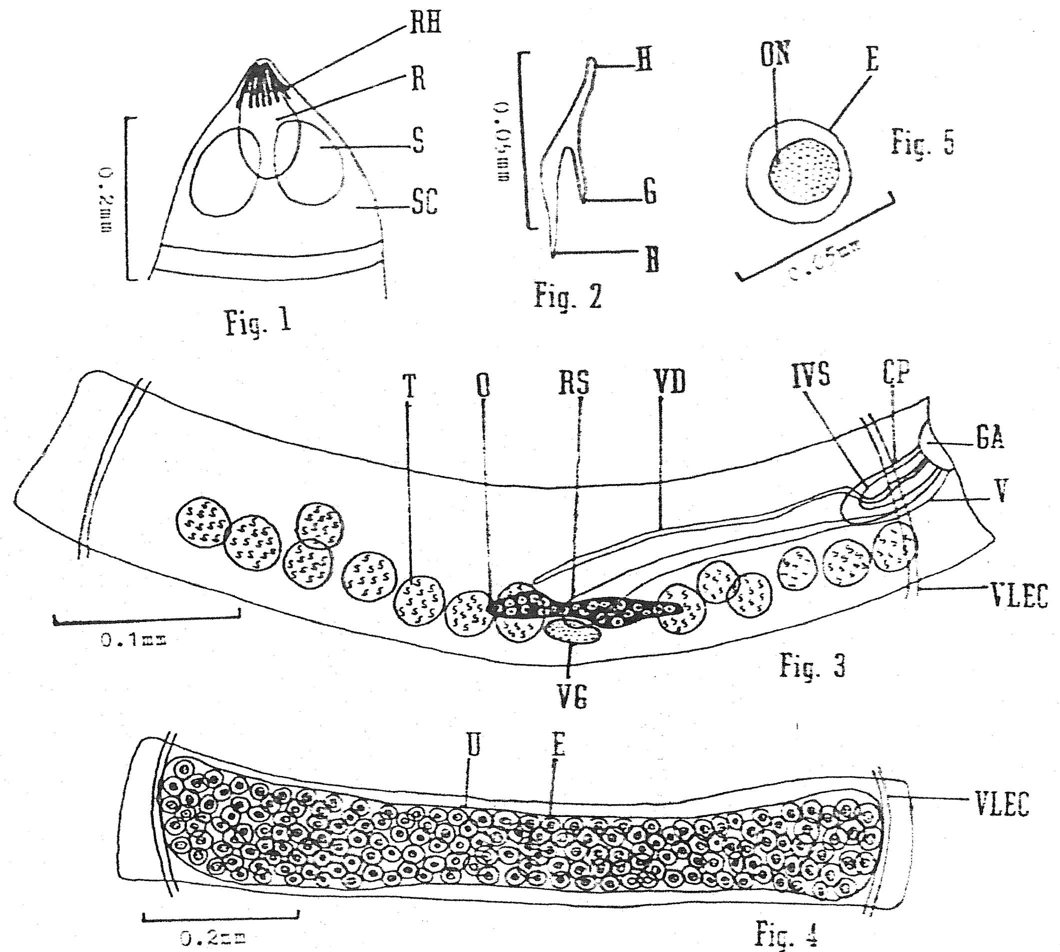
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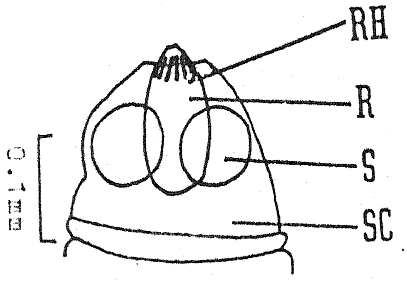
Fig. 4

PLATE 7



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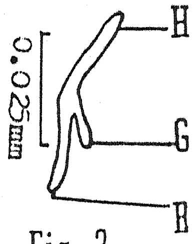

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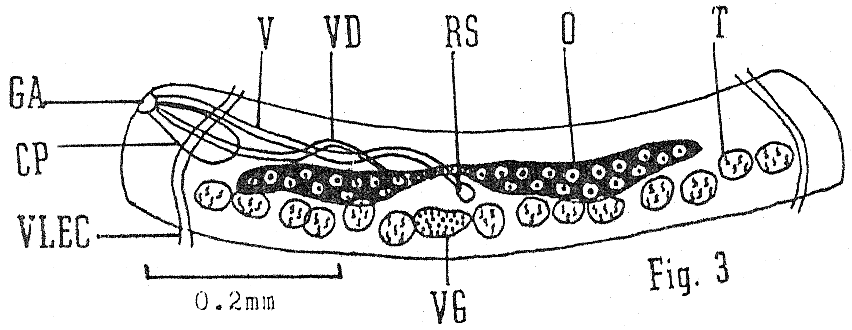

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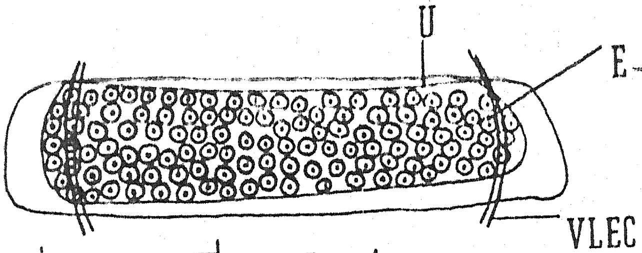

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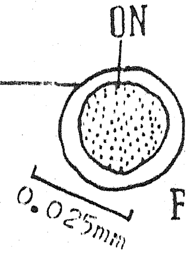

Fig. 5

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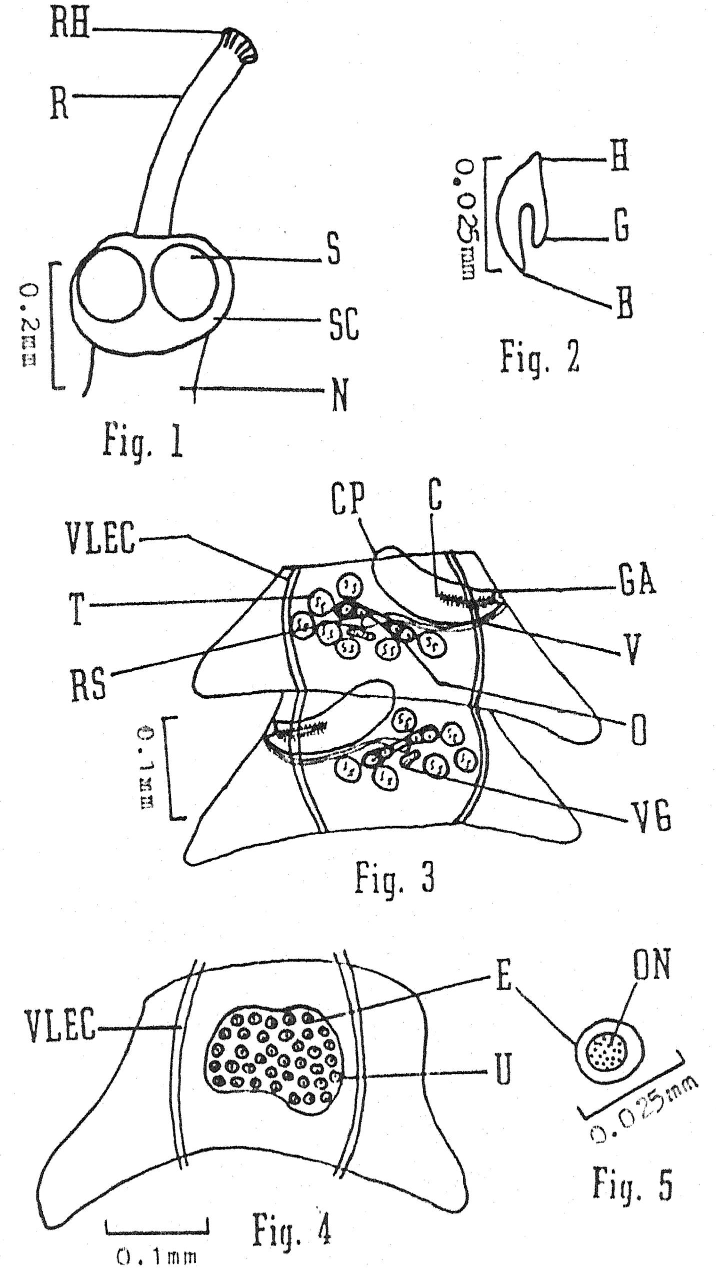
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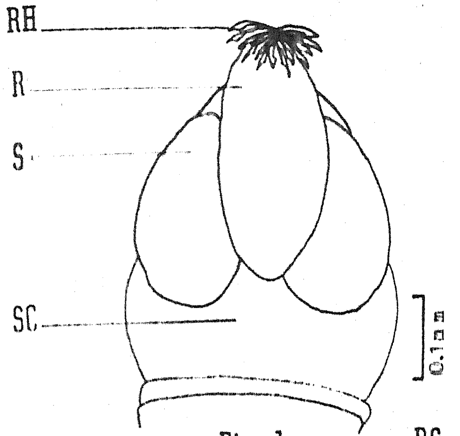
Fig. 4
Fig. 5

PLATE 9



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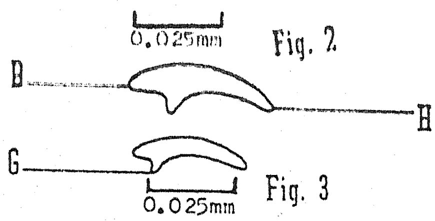
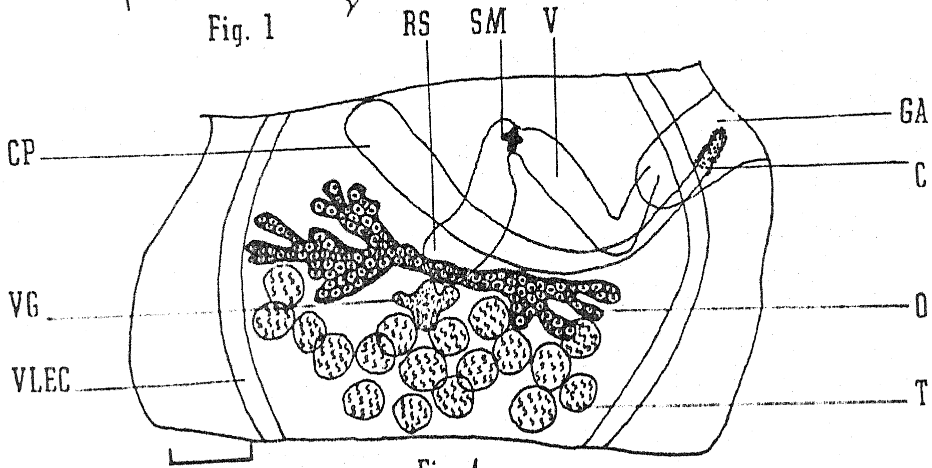


Fig. 2

Fig. 3



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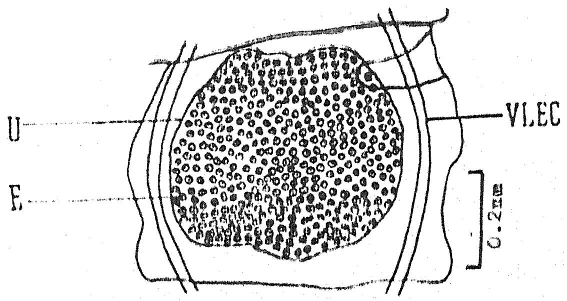

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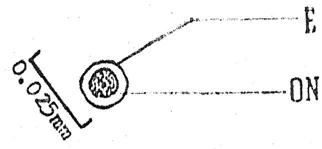
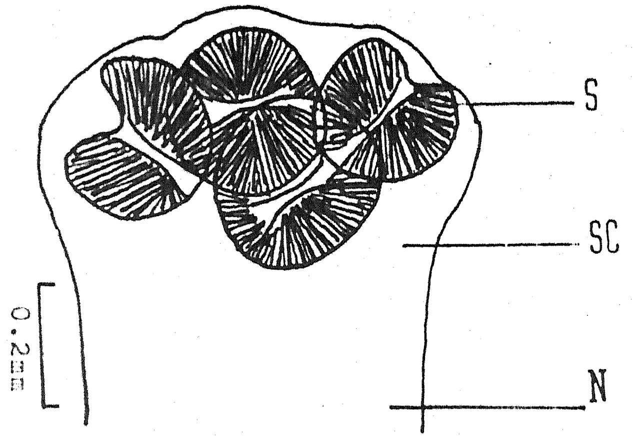


Fig. 6

PLATE 10



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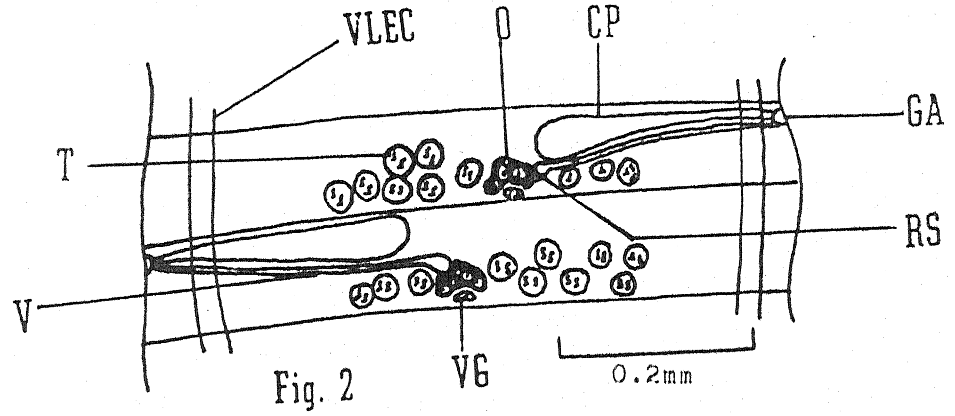

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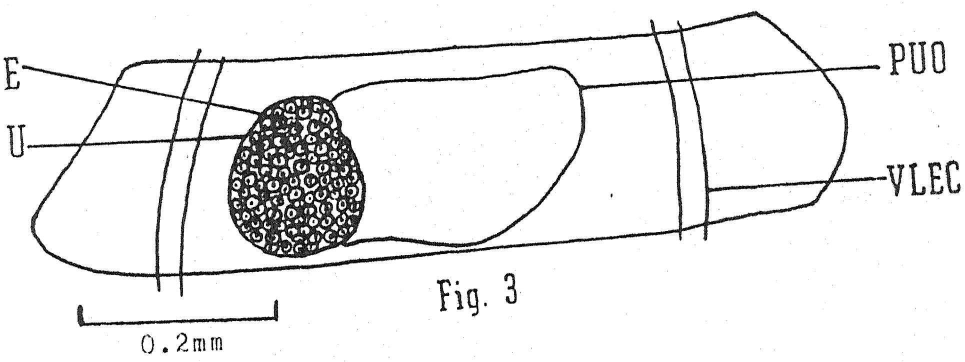


Fig. 3

PLATE II

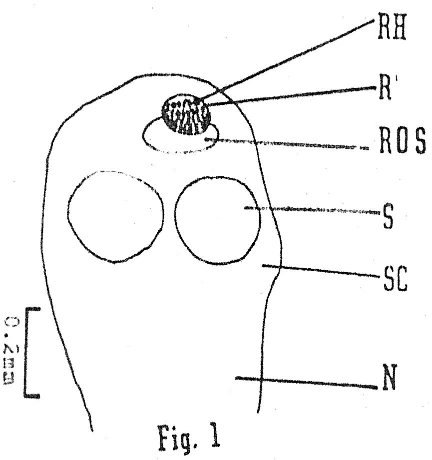
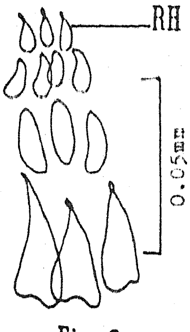


Fig. 1



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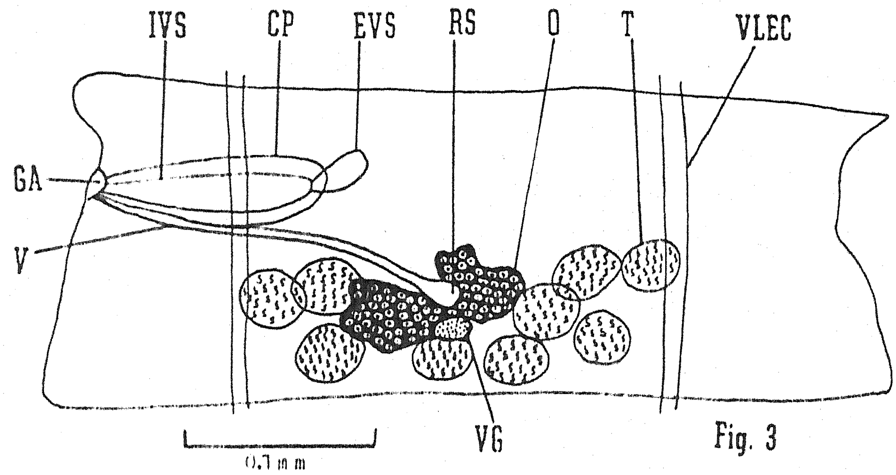

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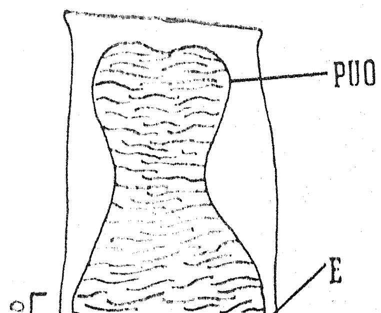

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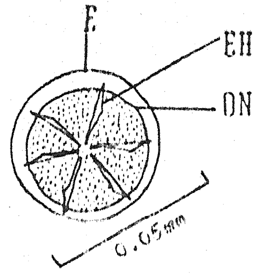

Fig. 5

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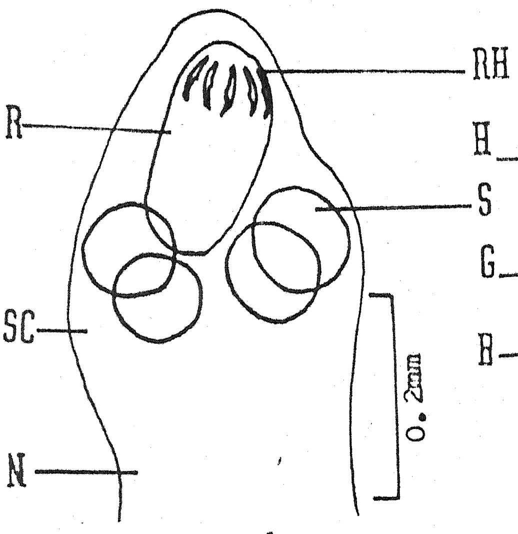

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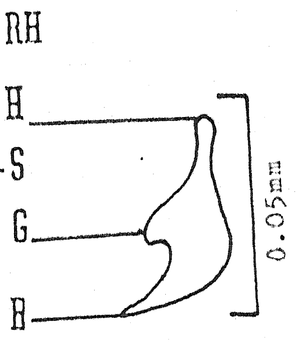

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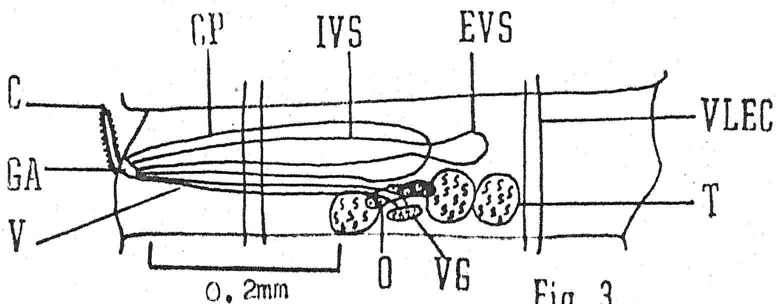

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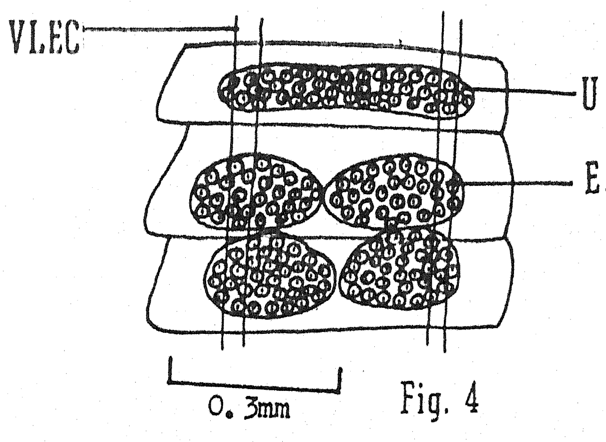

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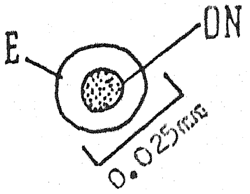


Fig. 5

PLATE 13

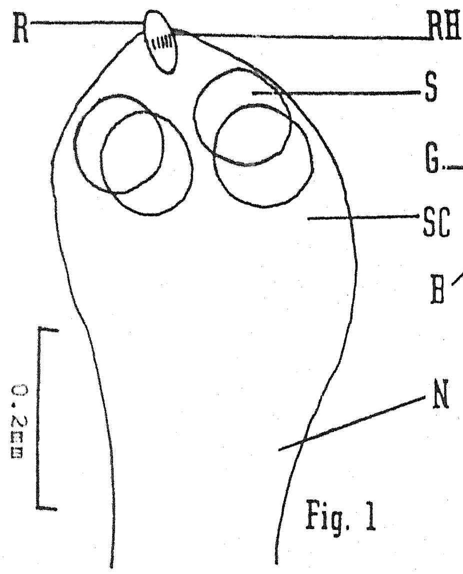
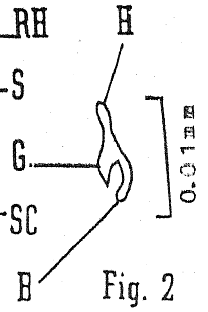


Fig. 1



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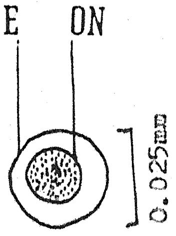

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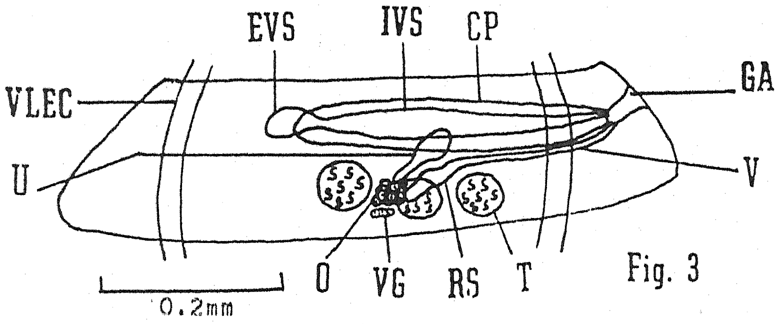


Fig. 3

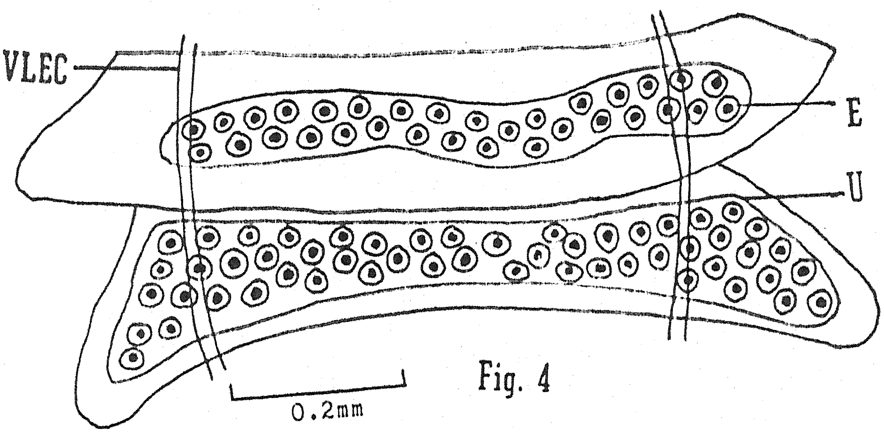


Fig. 4

PLATE 14

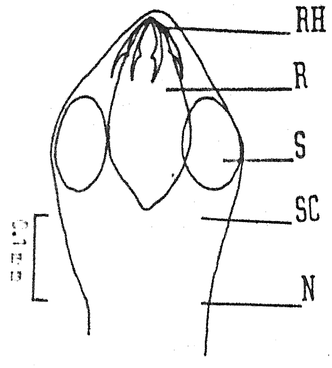
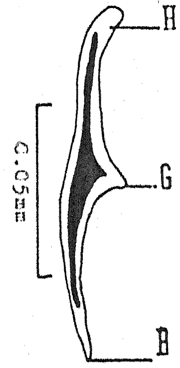


Fig. 1



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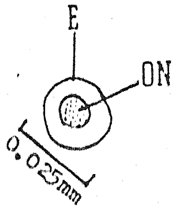

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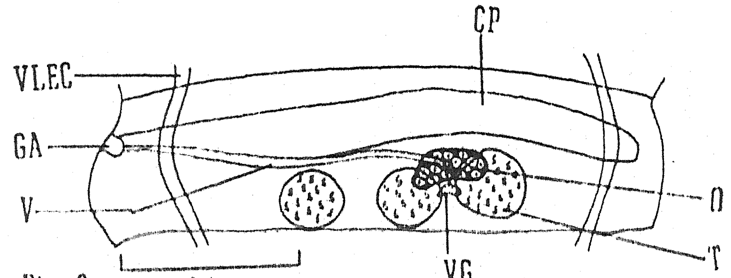


Fig. 3

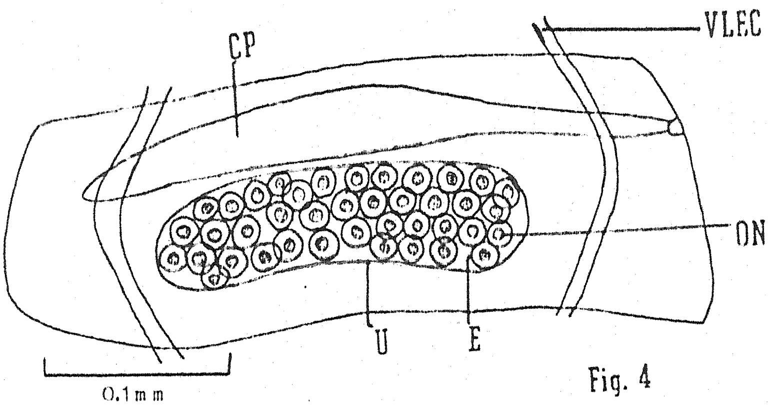


Fig. 4

PLATE 15

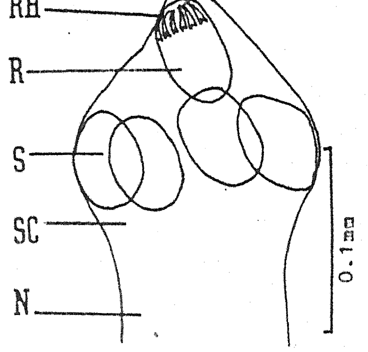


Fig. 1

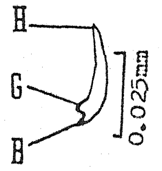


Fig. 2

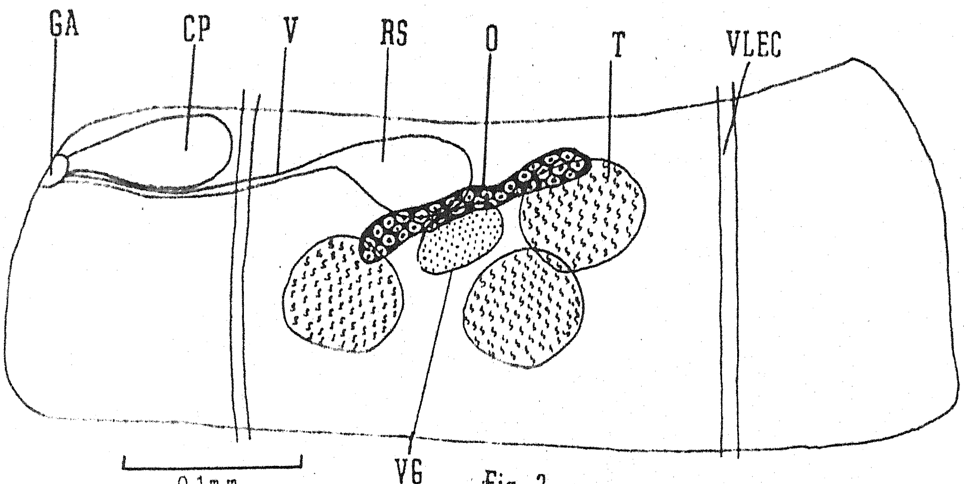


Fig. 3

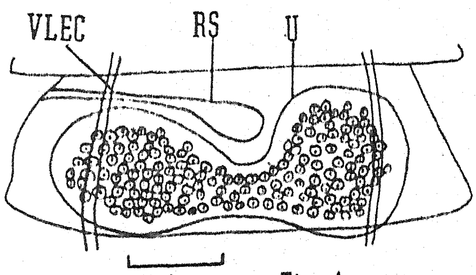


Fig. 4

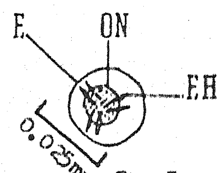


Fig. 5

PLATE 16

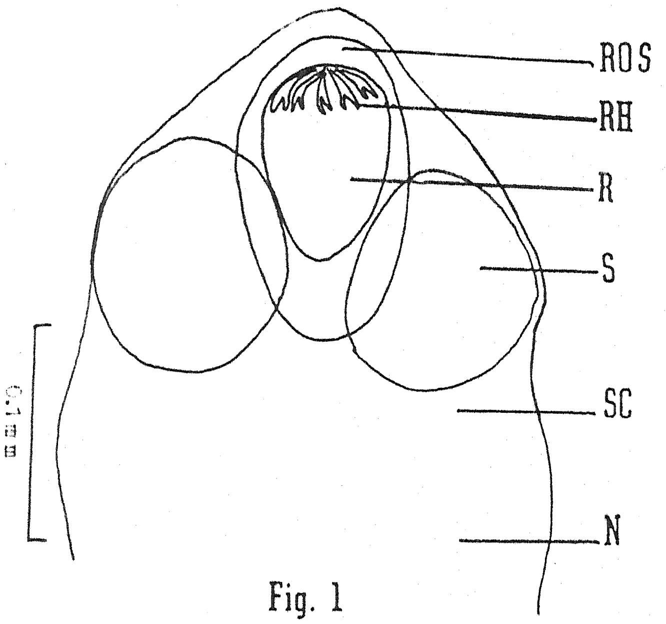
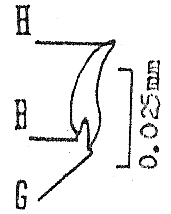


Fig. 1



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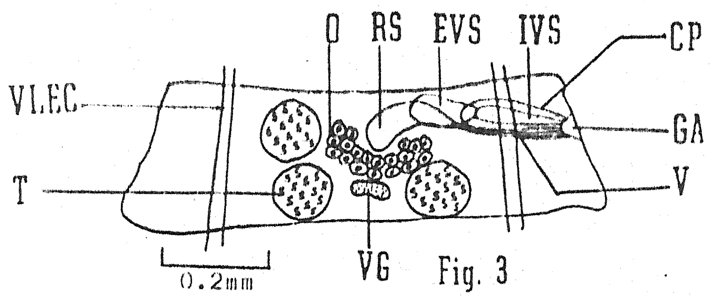


Fig. 3

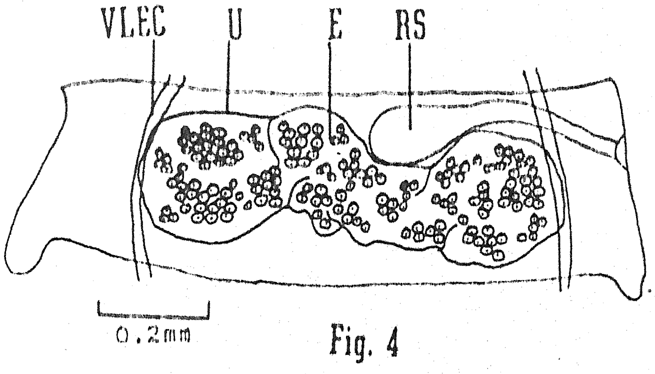


Fig. 4

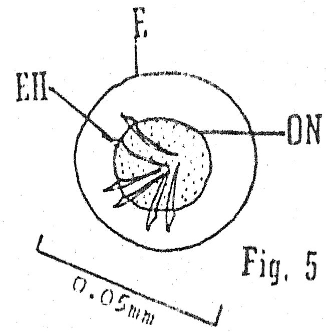


Fig. 5

PLATE 17

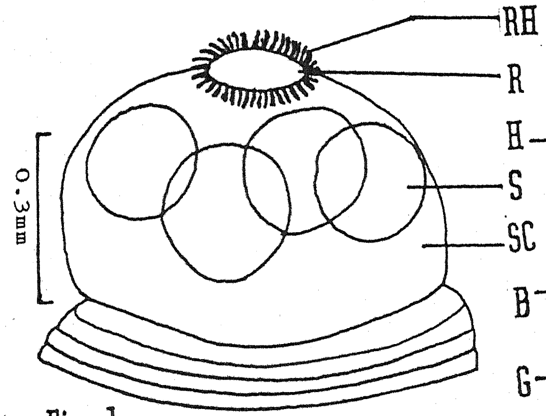
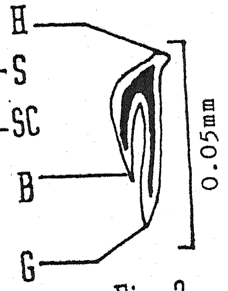


Fig. 1



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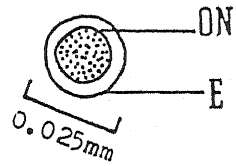

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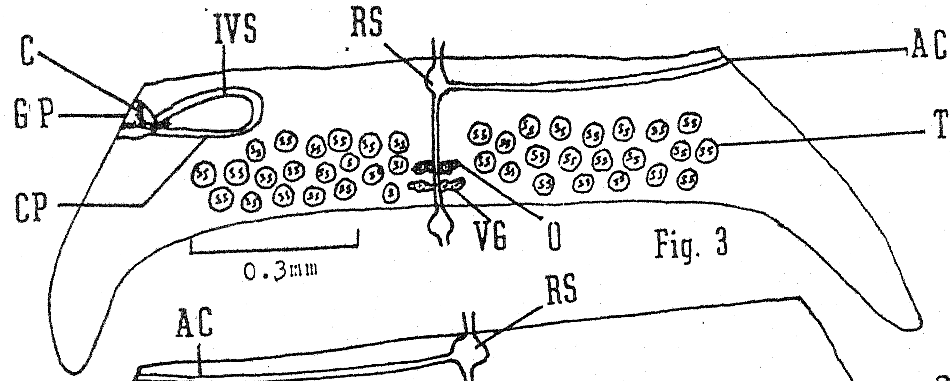
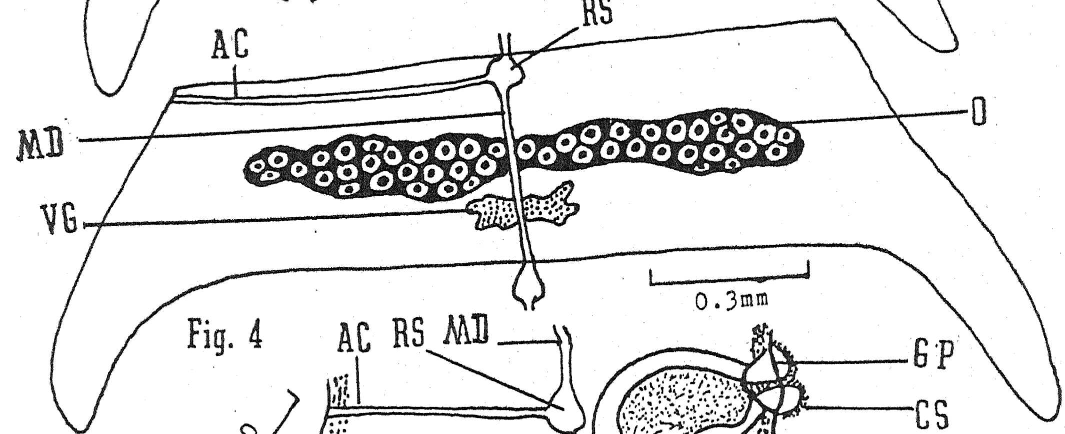


Fig. 3



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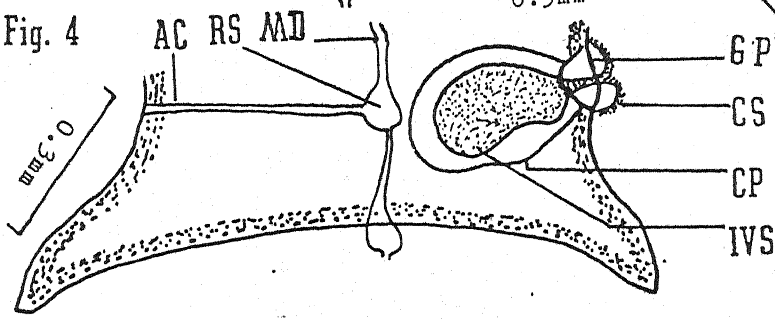


Fig. 5

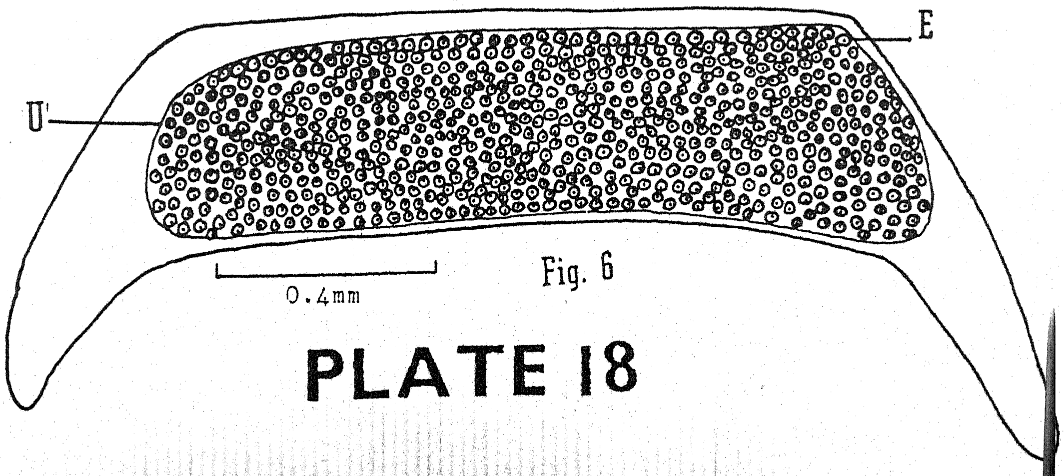


Fig. 6

PLATE 18

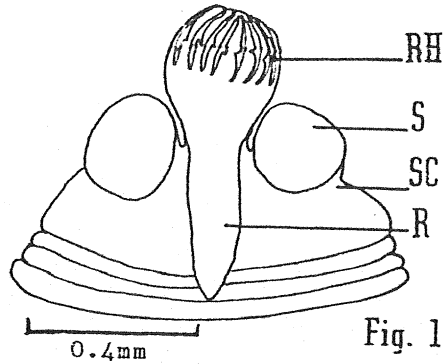
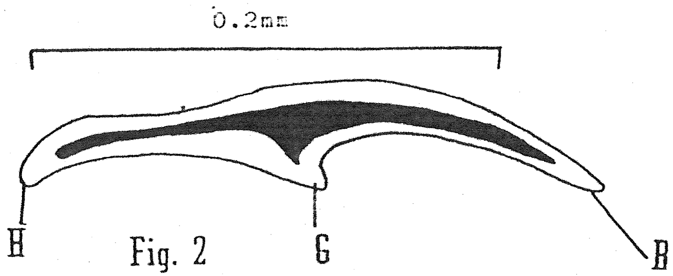


Fig. 1



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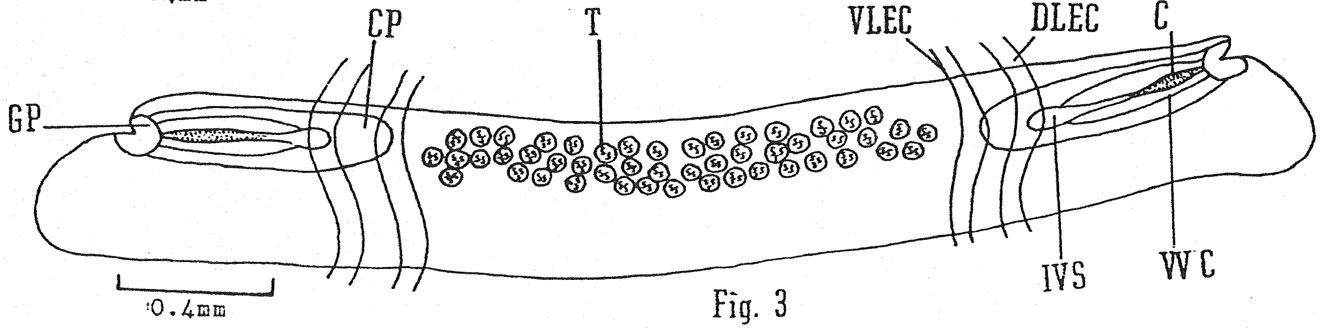


Fig. 3

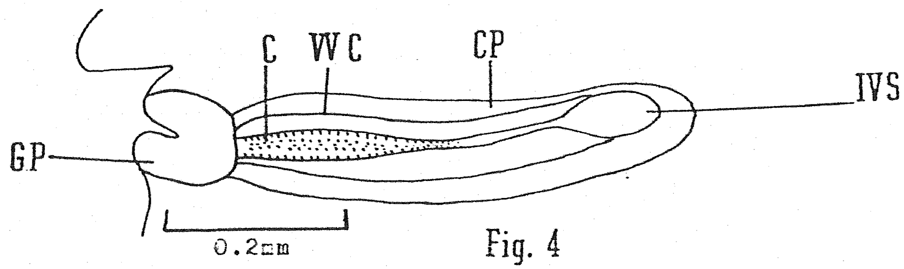
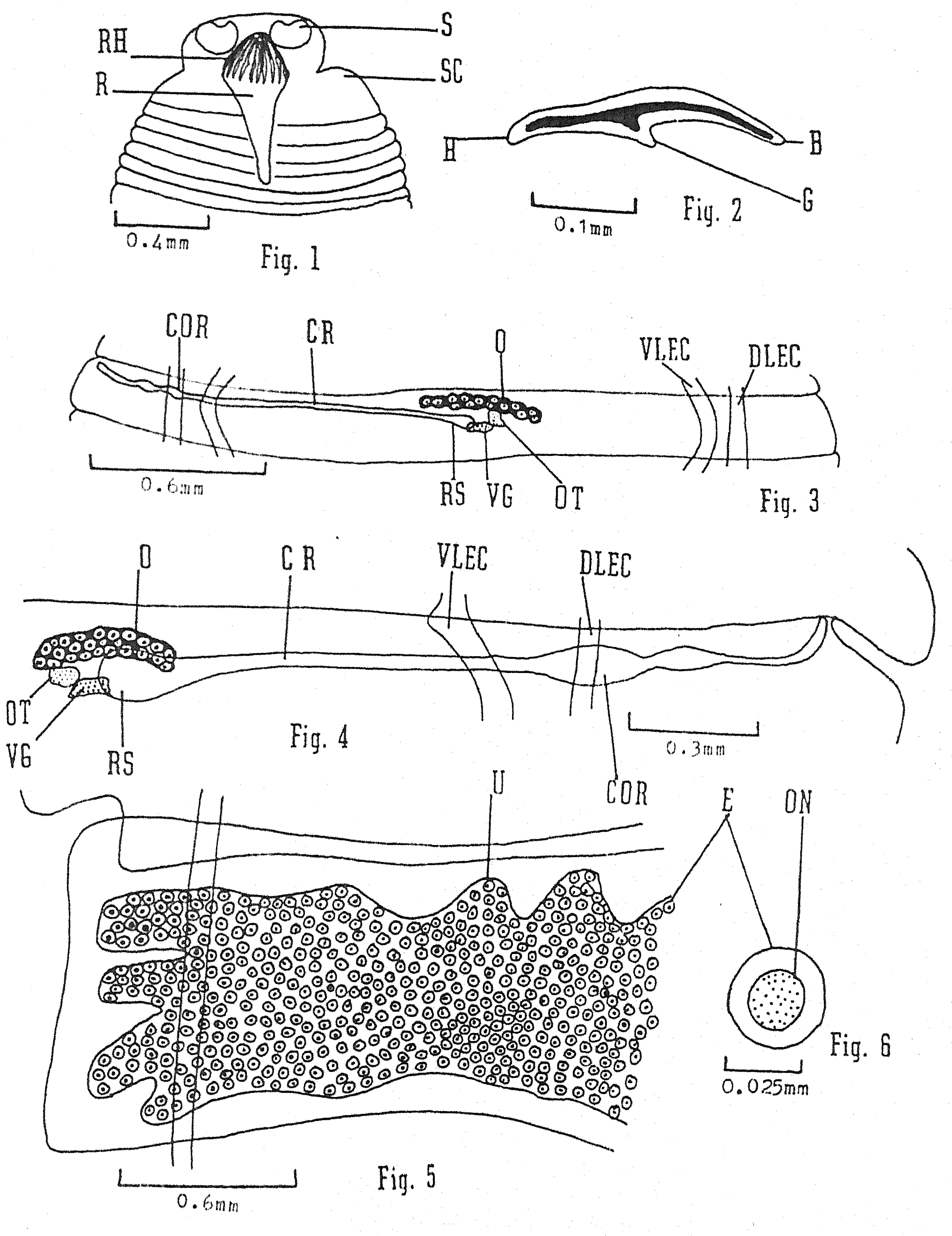


Fig. 4

PLATE 19



RH
R
S
SC
0.4mm
Fig. 1
H
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G
0.1mm
Fig. 2
COR
CR
O
VLEC
DLEC
0.6mm
RS
VG
OT
Fig. 3
O
CR
VLEC
DLEC
OT
VG
RS
Fig. 4
0.3mm
U
COR
E
ON
Fig. 6
0.025mm
0.6mm
Fig. 5

PLATE 20

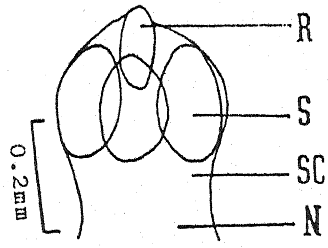


Fig. 1

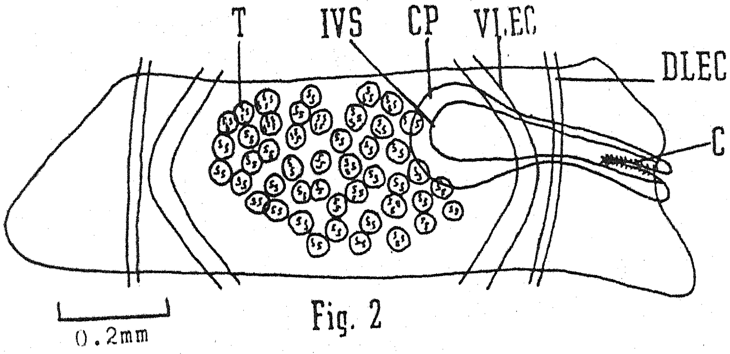


Fig. 2

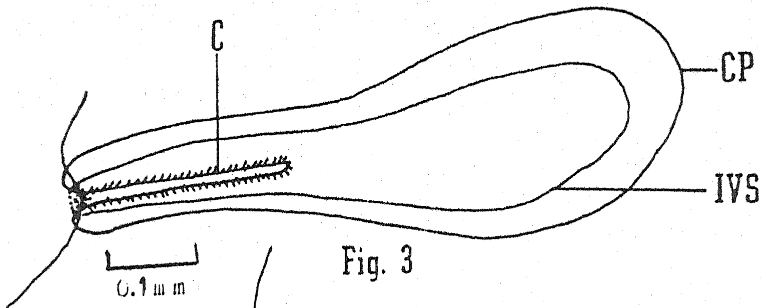


Fig. 3

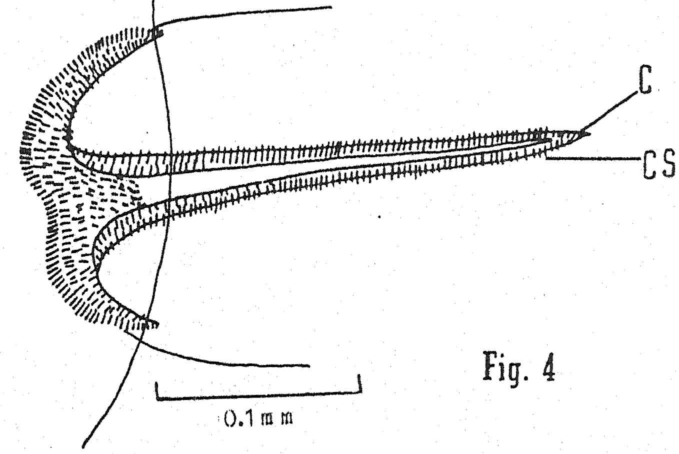


Fig. 4

PLATE 21

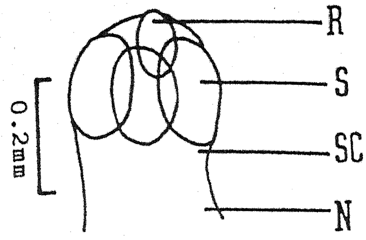
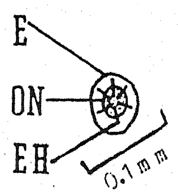


Fig. 1



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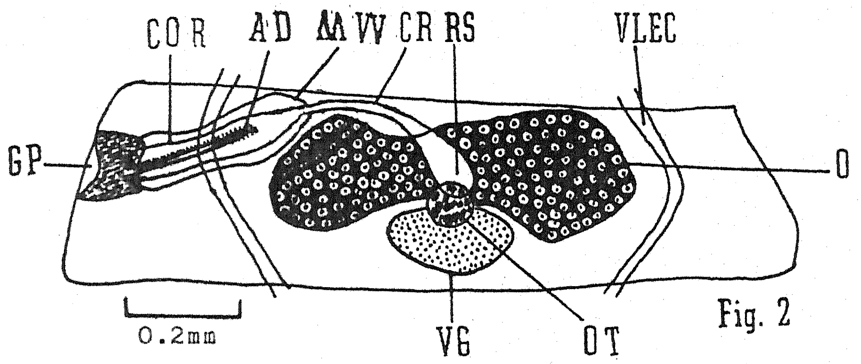


Fig. 2

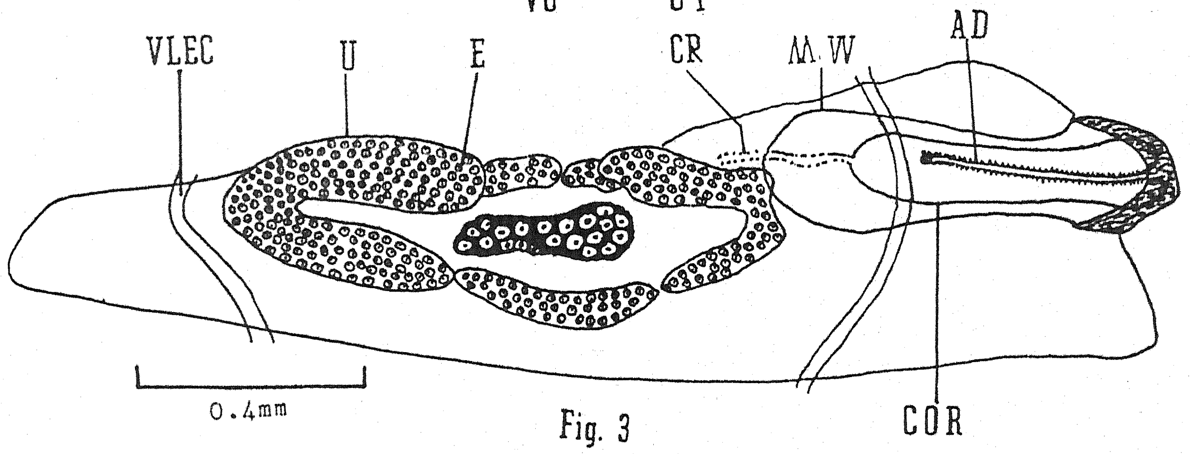


Fig. 3

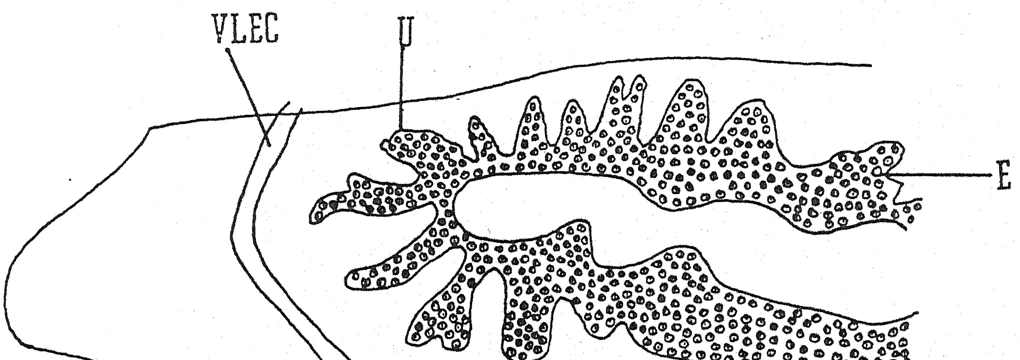


Fig. 4

PLATE 22

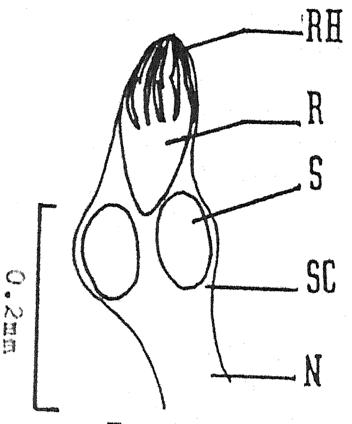
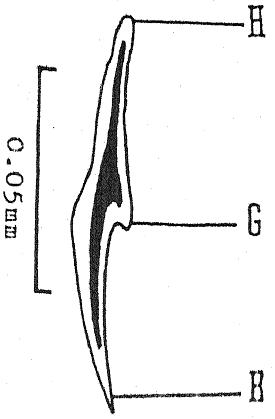


Fig. 1



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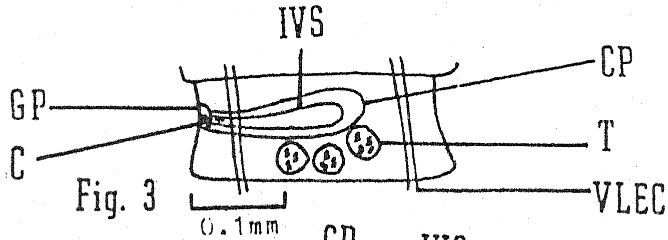

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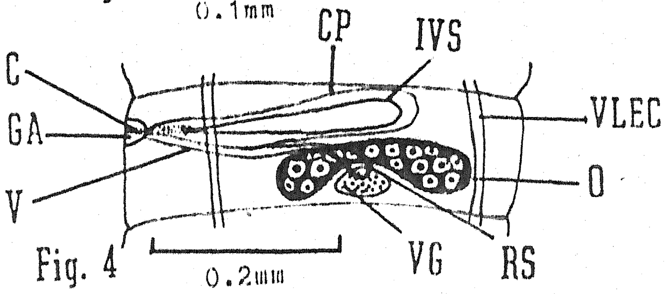

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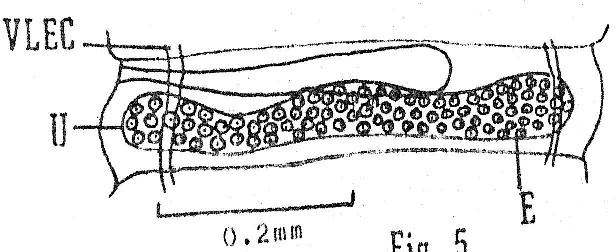


Fig. 5

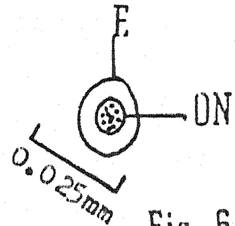


Fig. 6

PLATE 23

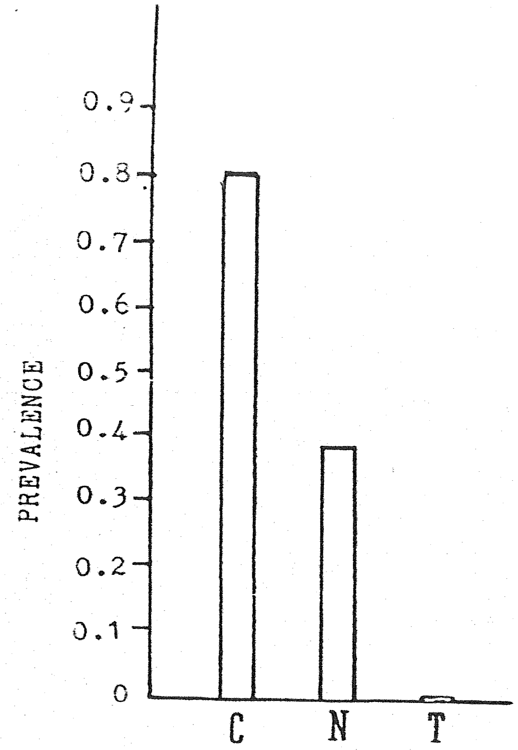


Fig. 1

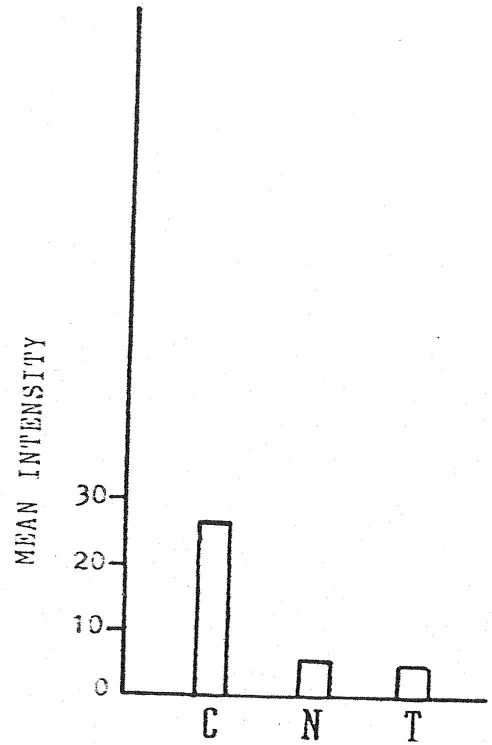


Fig. 2

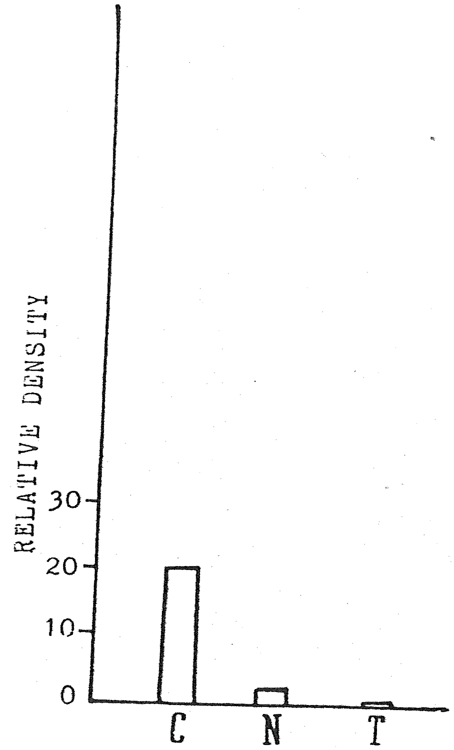
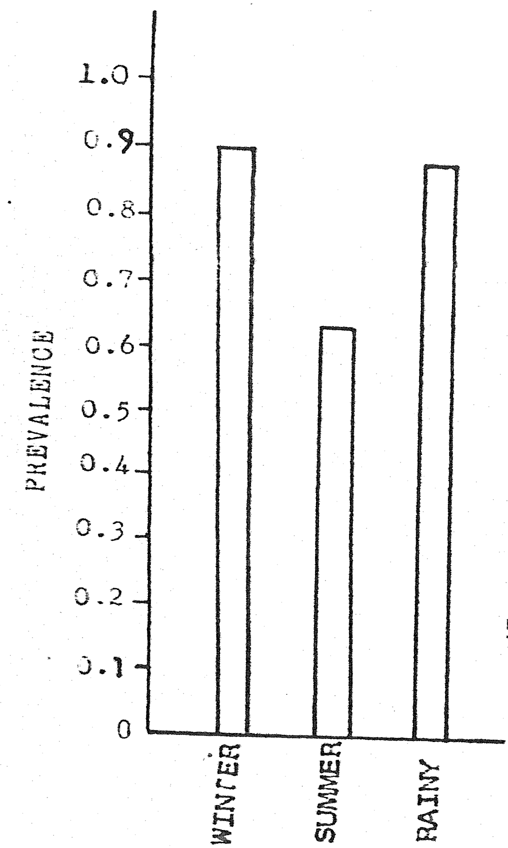


Fig. 3

PLATE 24



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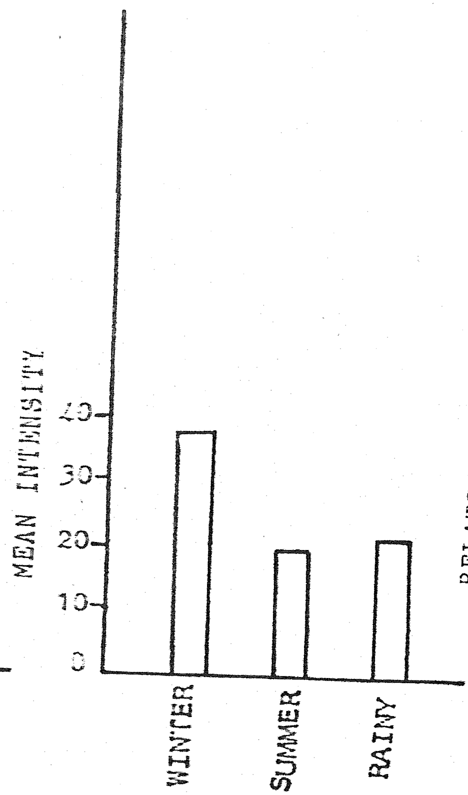

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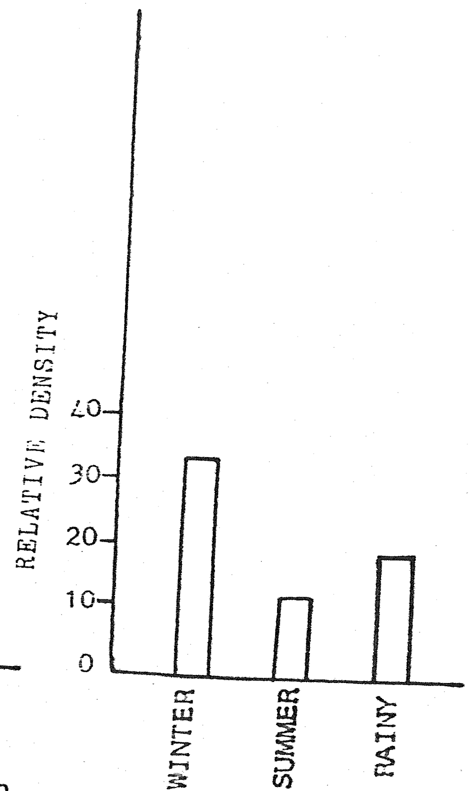


Fig. 3

PLATE 25

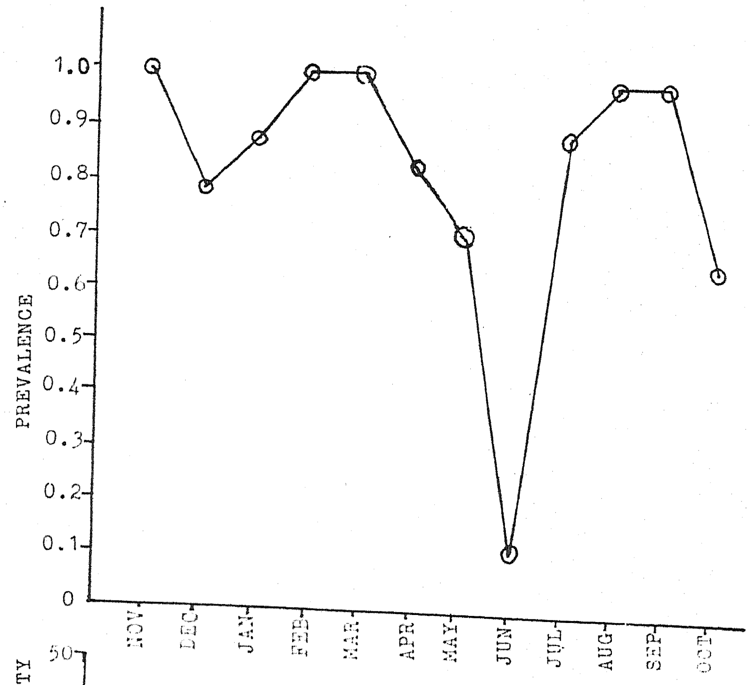


Fig. 1

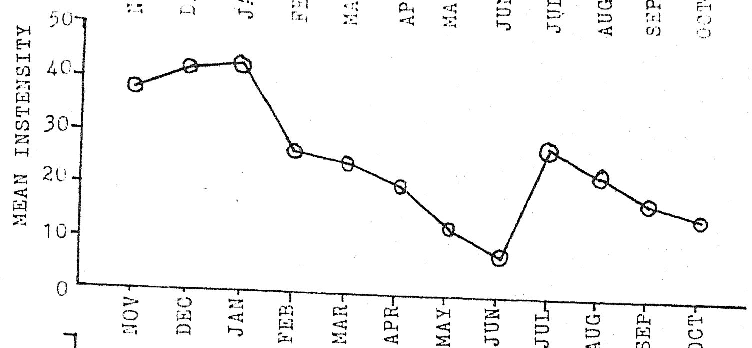


Fig. 2

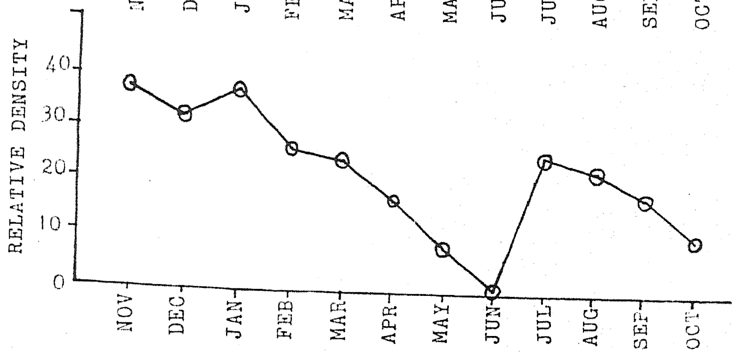


Fig. 3

PLATE 26

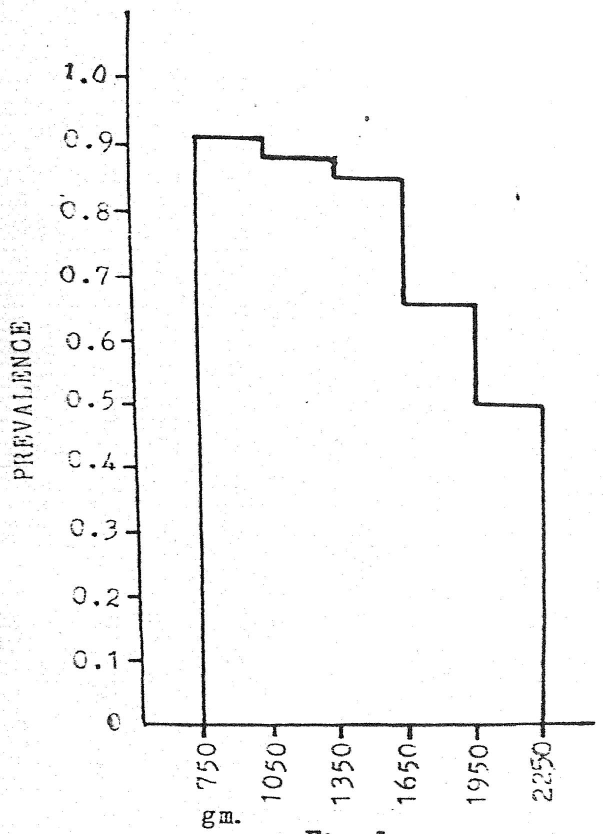


Fig. 1

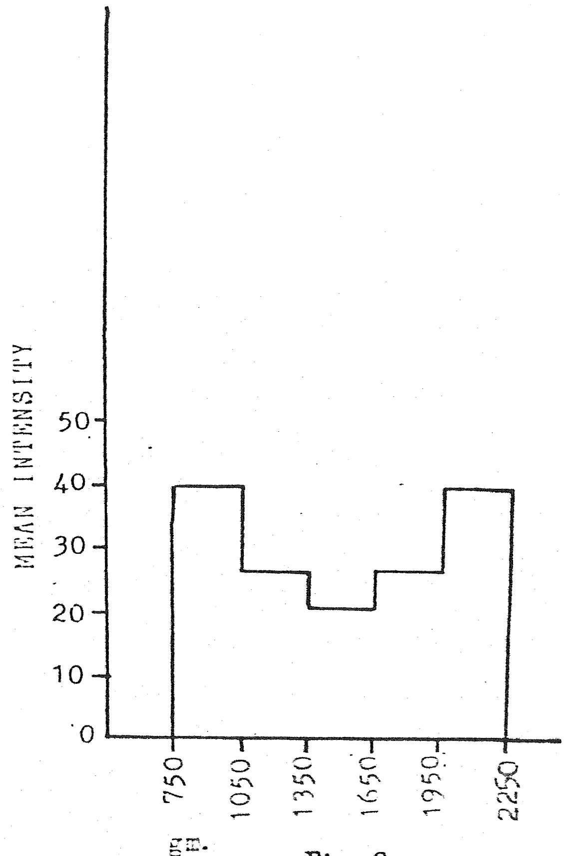


Fig. 2

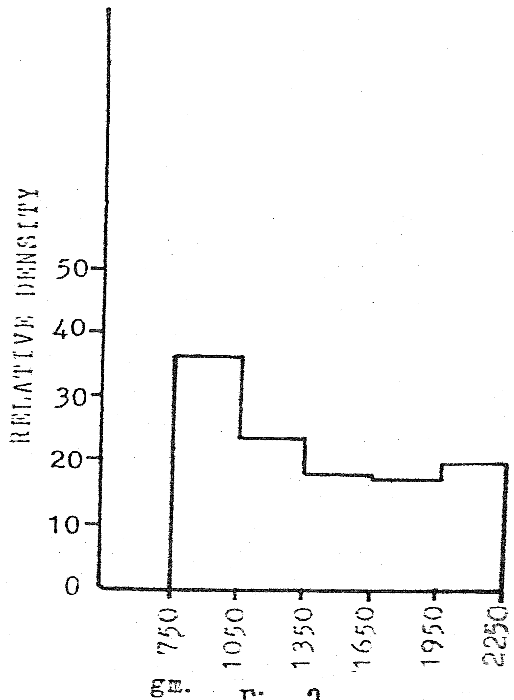


Fig. 3

PLATE 27

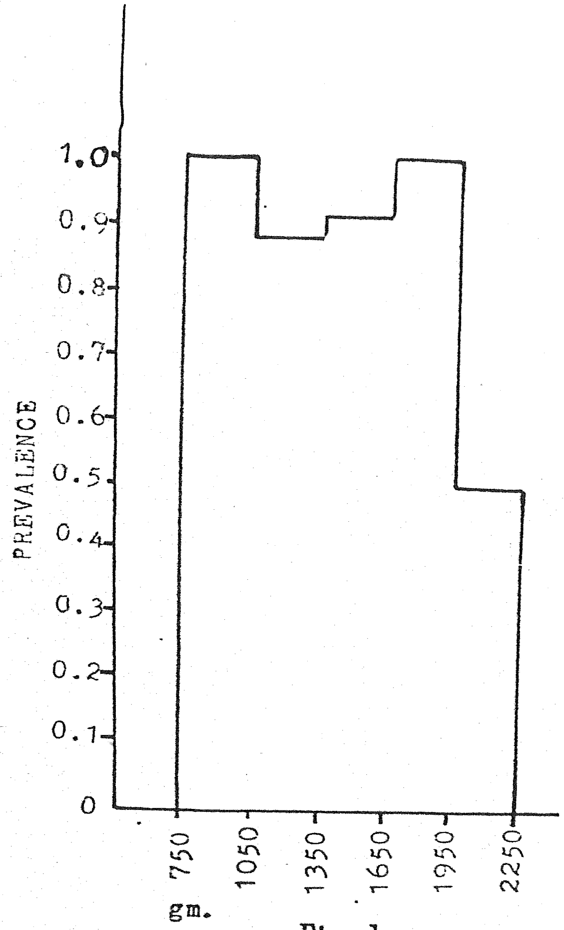


Fig. 1 WINTER

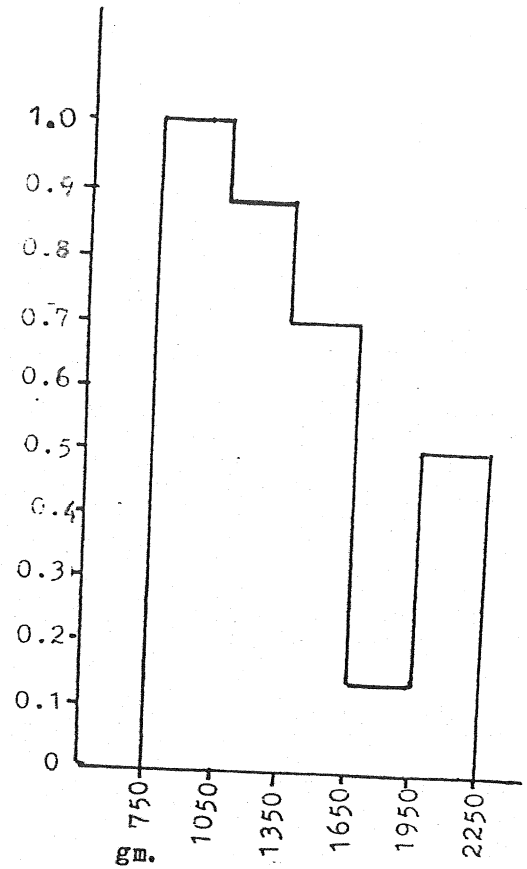


Fig. 2 SUMMER

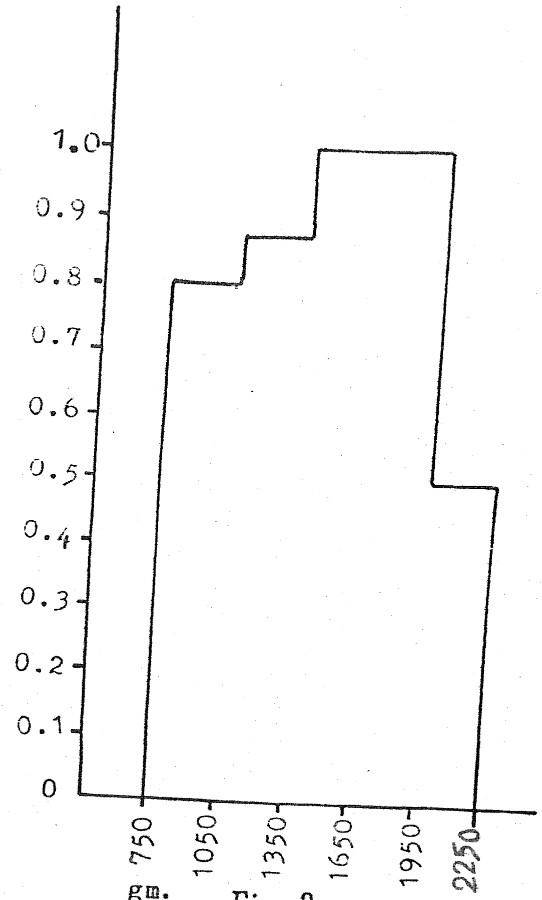


Fig. 3 RAINY

PLATE 28

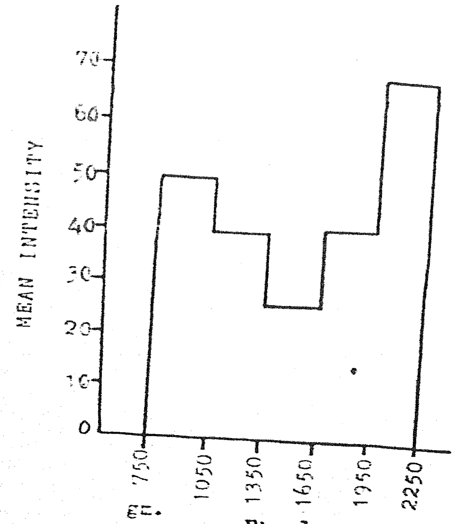


Fig. 1 WINTER

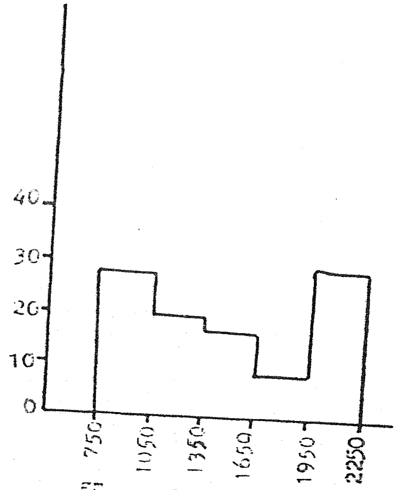


Fig. 2 SUMMER

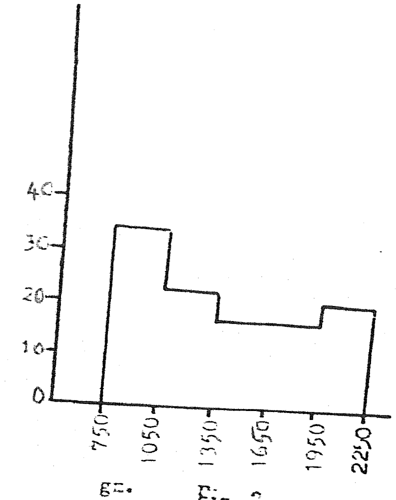


Fig. 3 RAINY

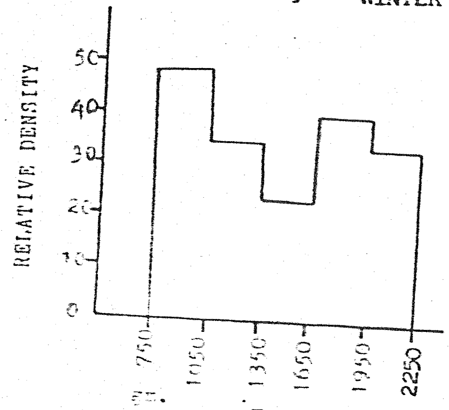


Fig. 4 WINTER

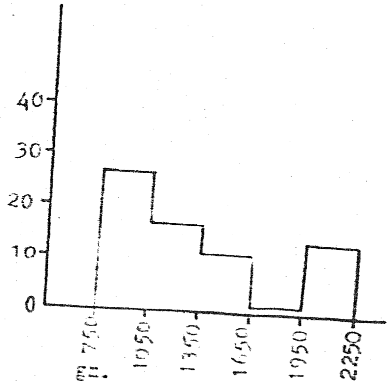


Fig. 5 SUMMER

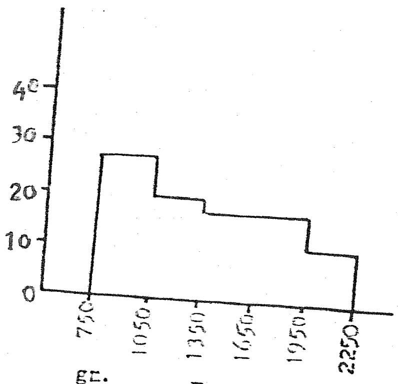


Fig. 6 RAINY

PLATE 29

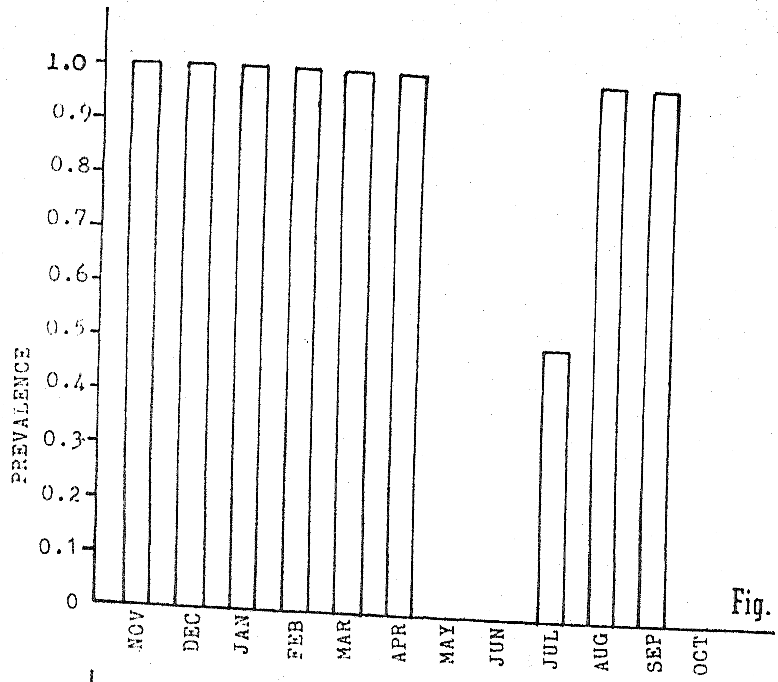


Fig. 1

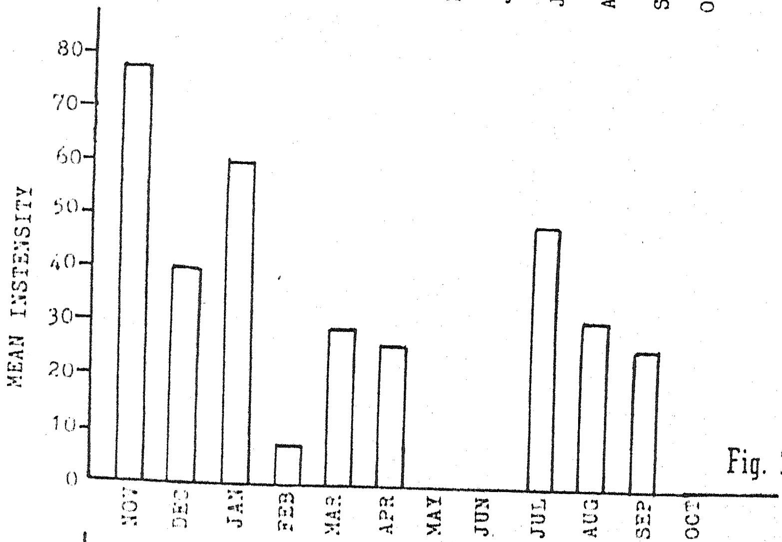


Fig. 2

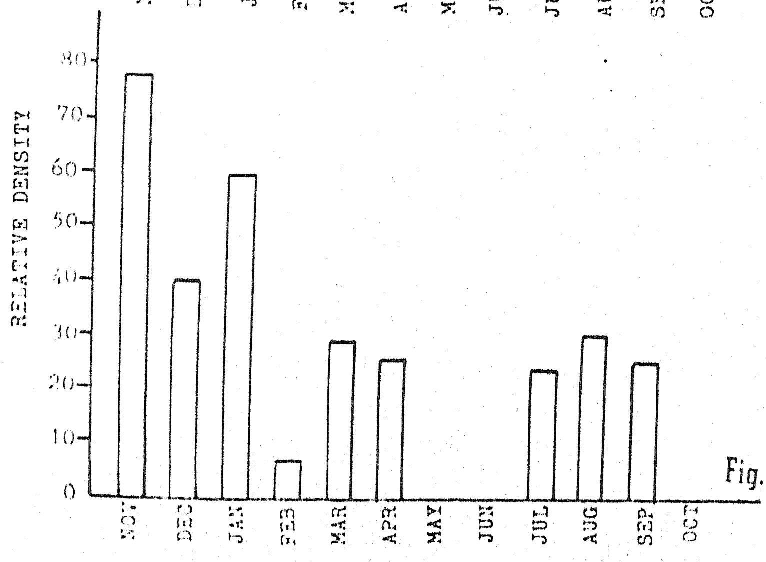
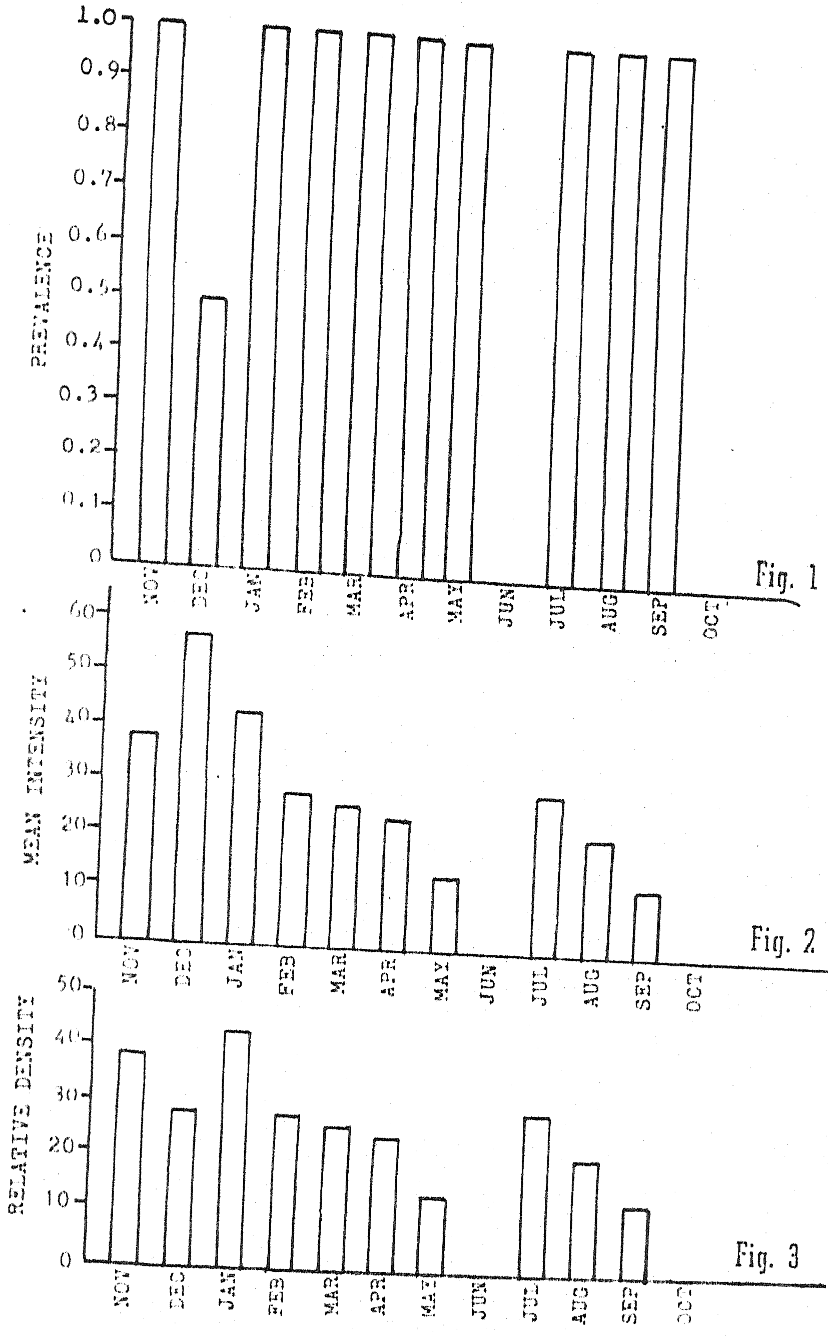


Fig. 3

750-1050gm.

PLATE 30



1051-1350gm.

PLATE 31

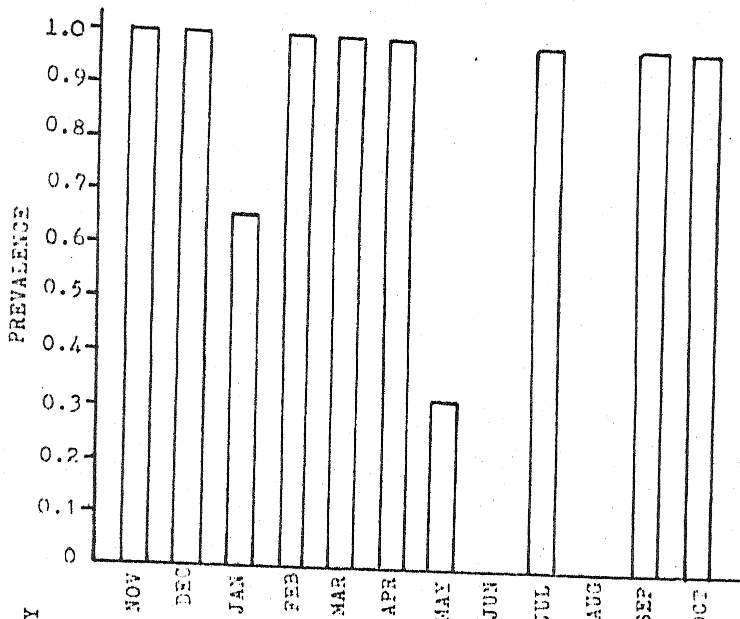


Fig. 1

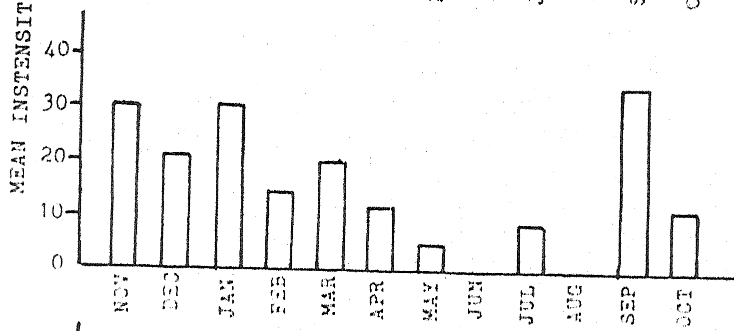


Fig. 2

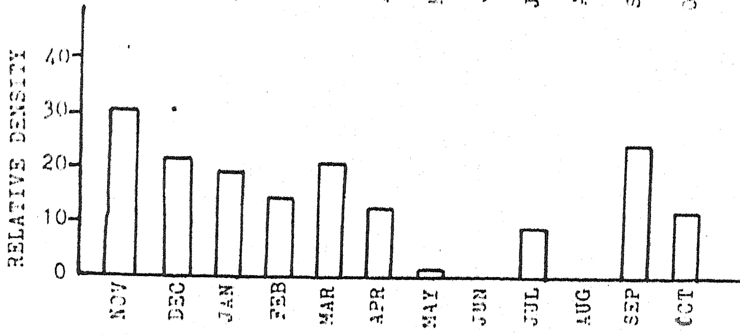


Fig. 3

1351-1650gm.

PLATE 32

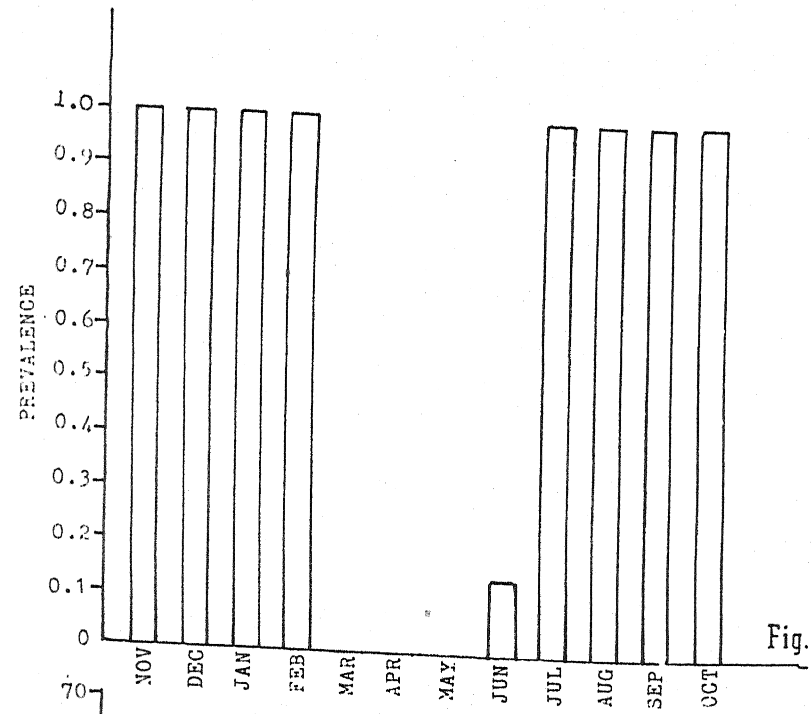


Fig. 1

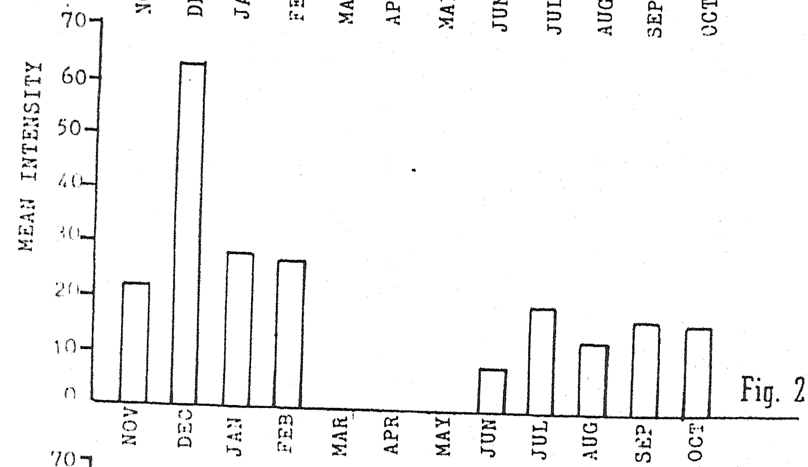


Fig. 2

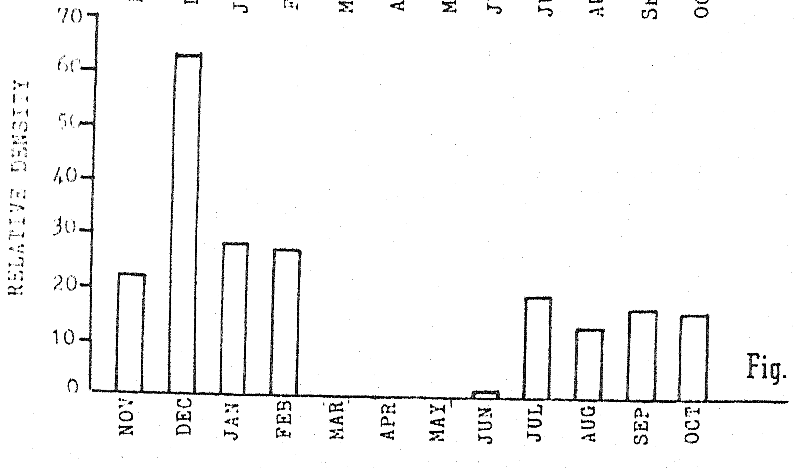


Fig. 3

1651-1950 gm.

PLATE 33

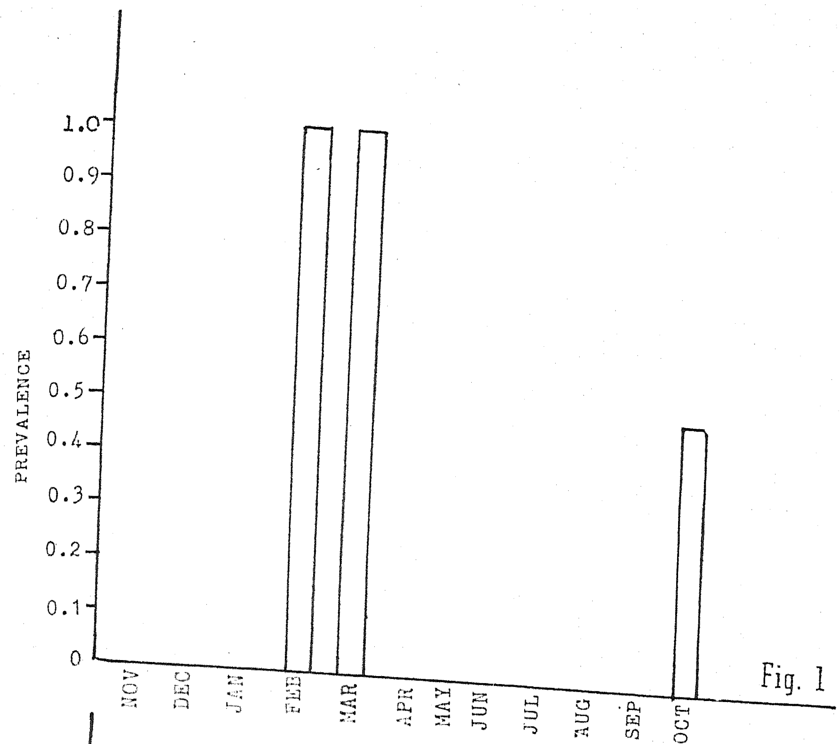
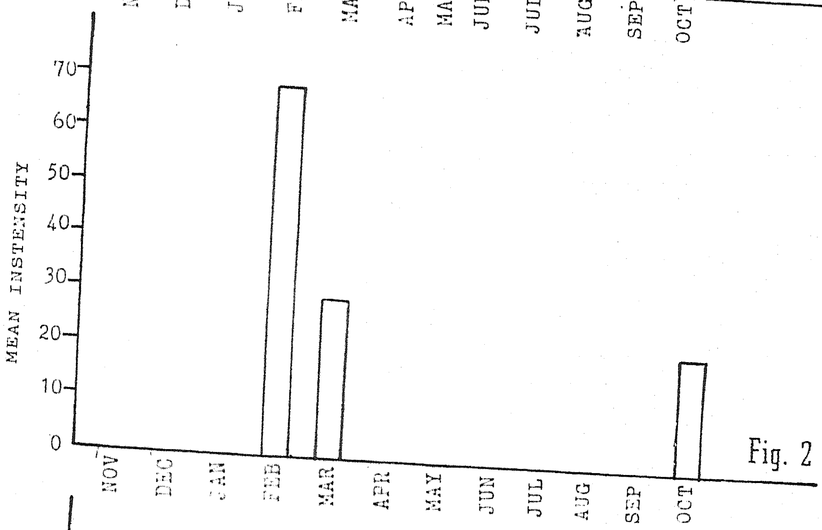


Fig. 1



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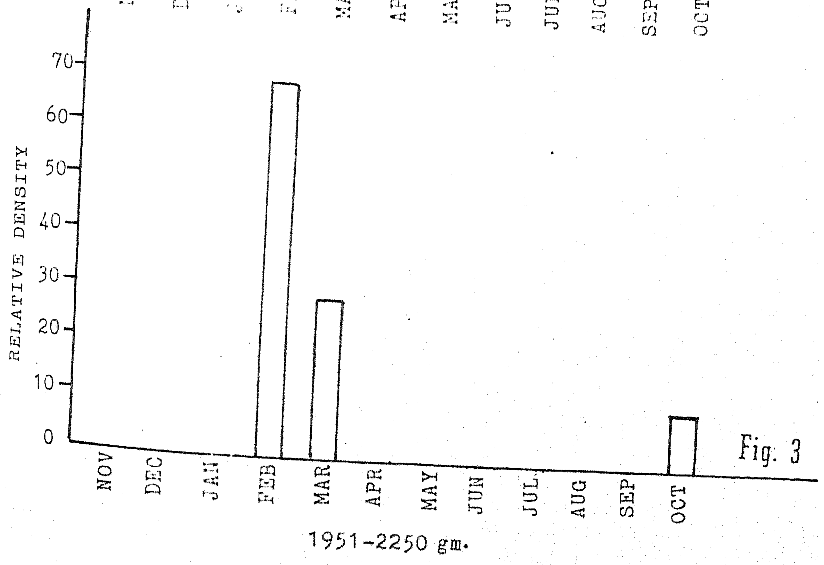


Fig. 3

1951-2250 gm.

PLATE 34

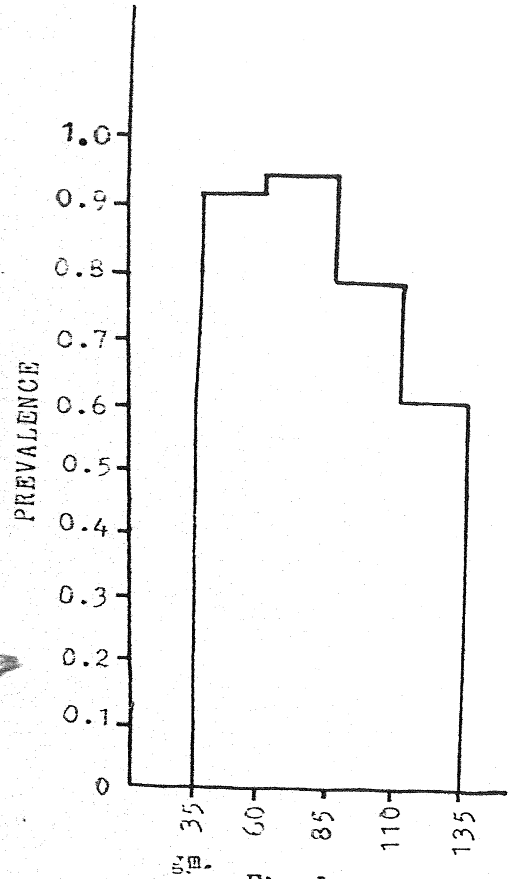


Fig. 1

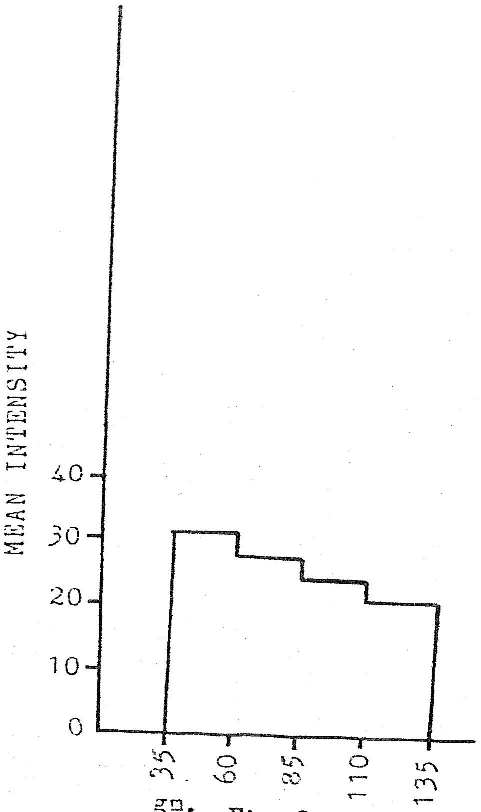


Fig. 2

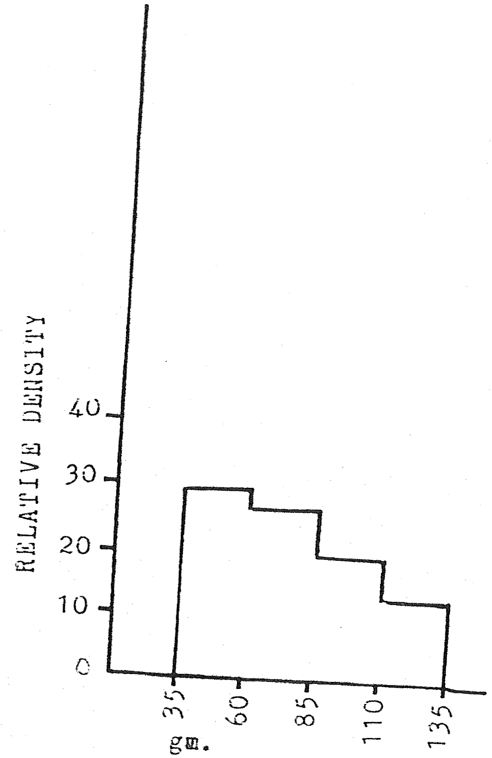


Fig. 3

PLATE 35

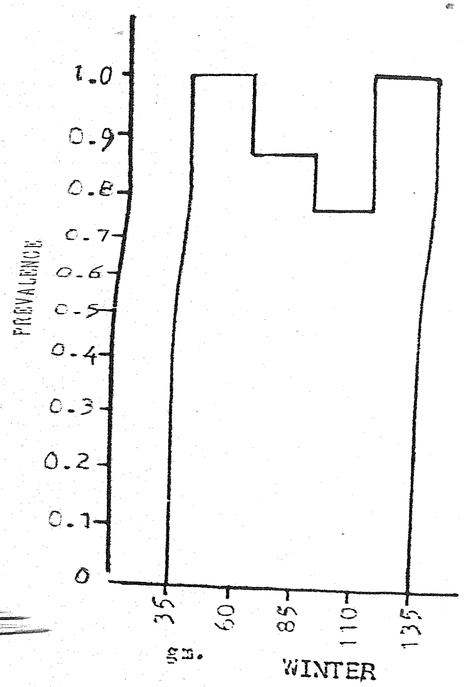


Fig. 1

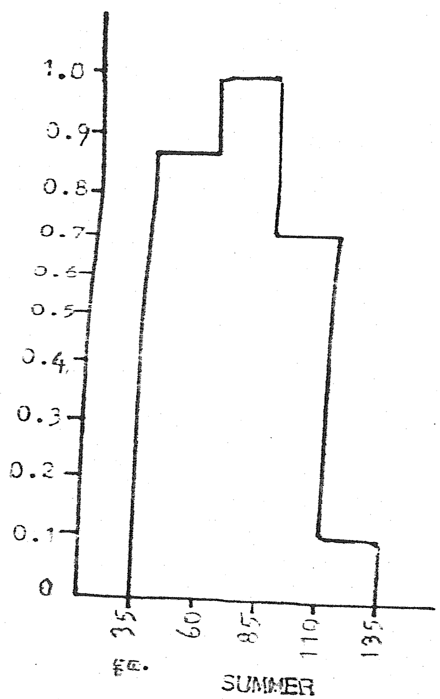


Fig. 2

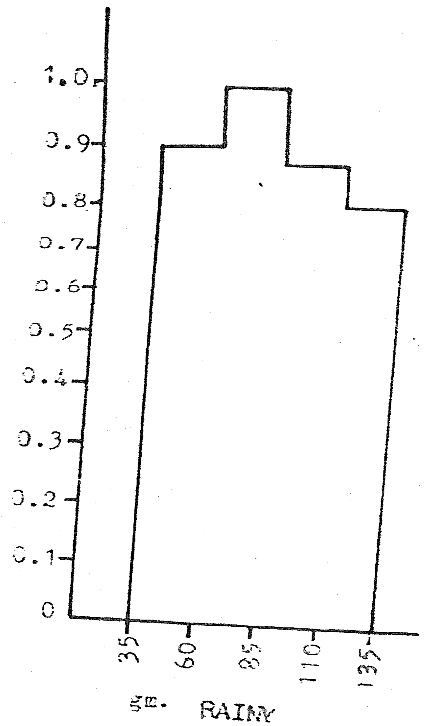


Fig. 3

PLATE 36

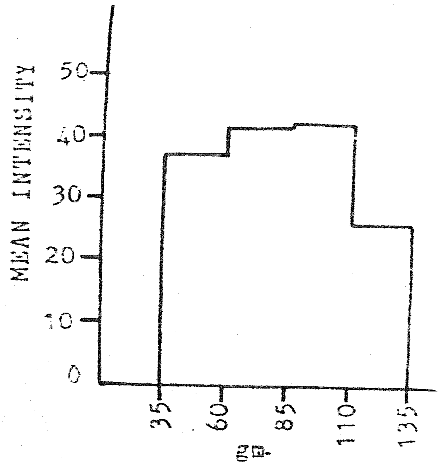


Fig. 1 WINTER

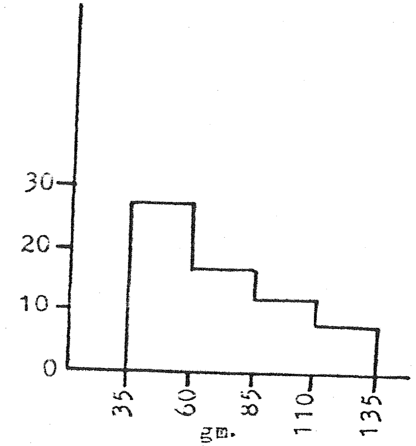


Fig. 2 SUMMER

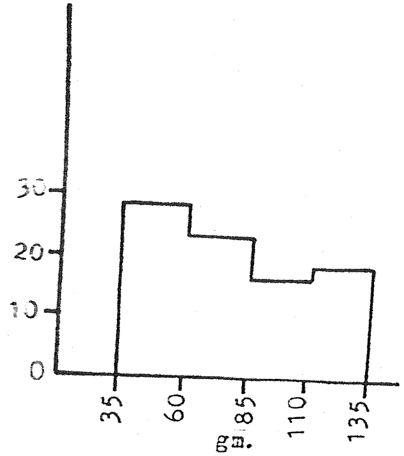


Fig. 3 RAINY

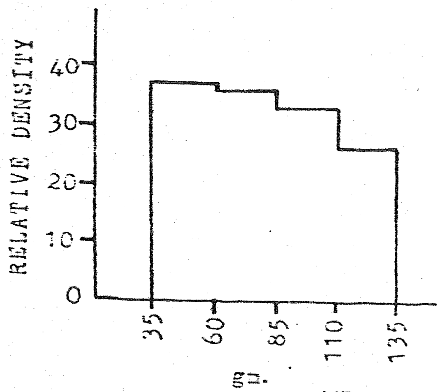


Fig. 4 WINTER

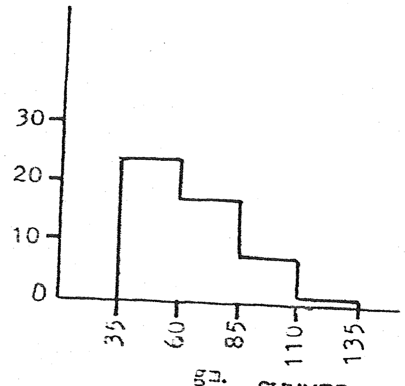


Fig. 5 SUMMER

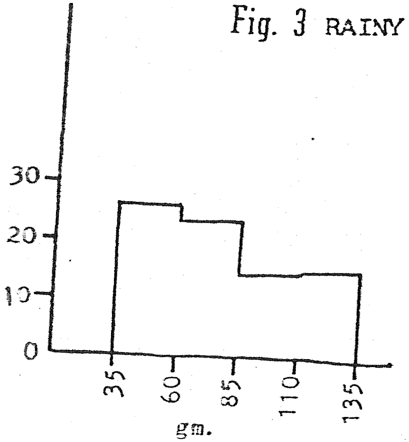


Fig. 6 RAINY

PLATE 37

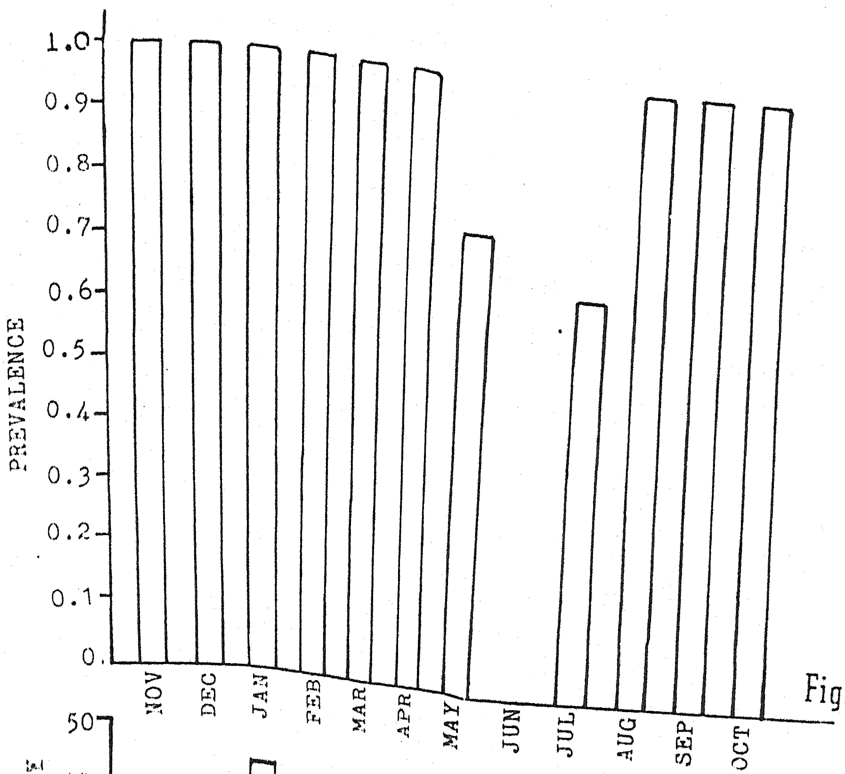


Fig. 1

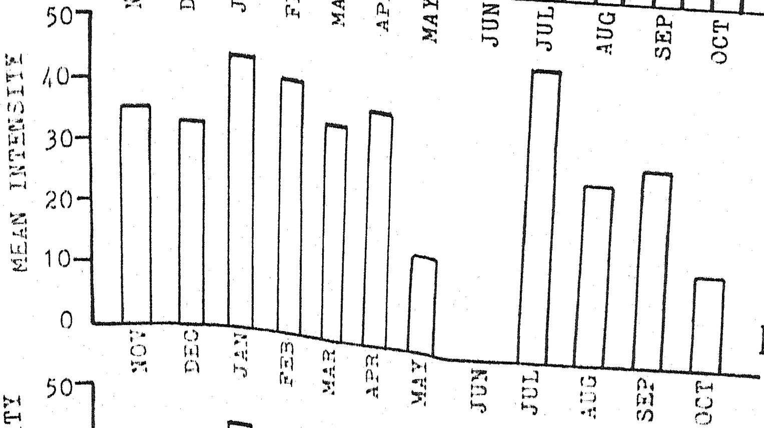


Fig. 2

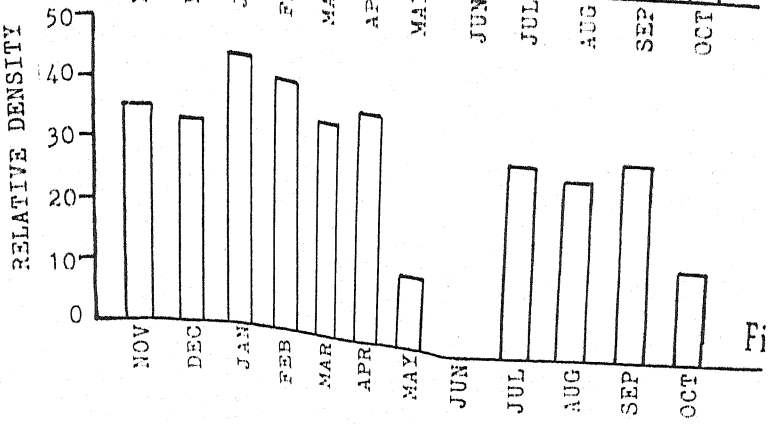


Fig. 3

35-60gm.

PLATE 38

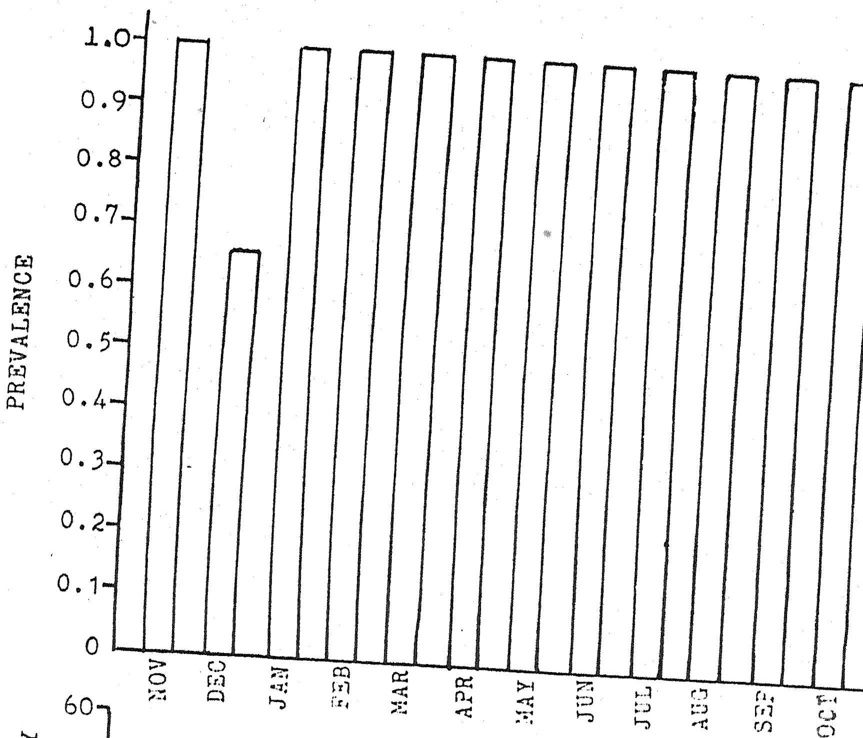


Fig. 1

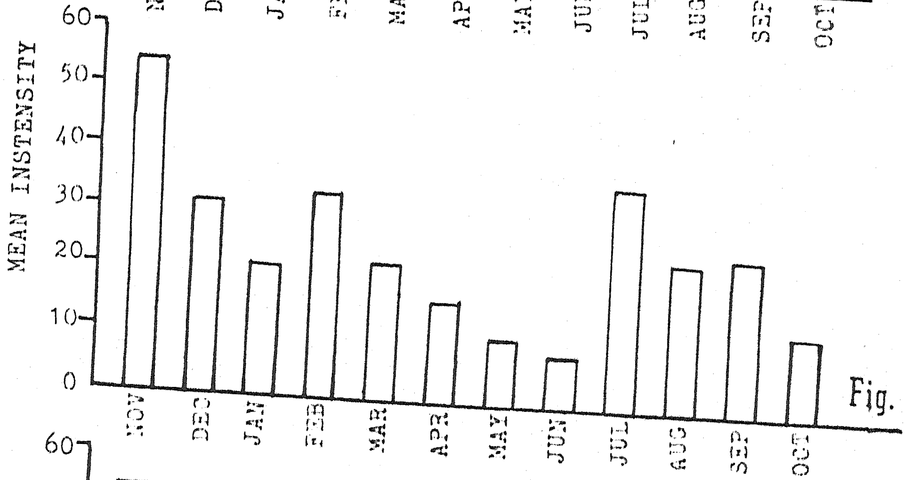


Fig. 2

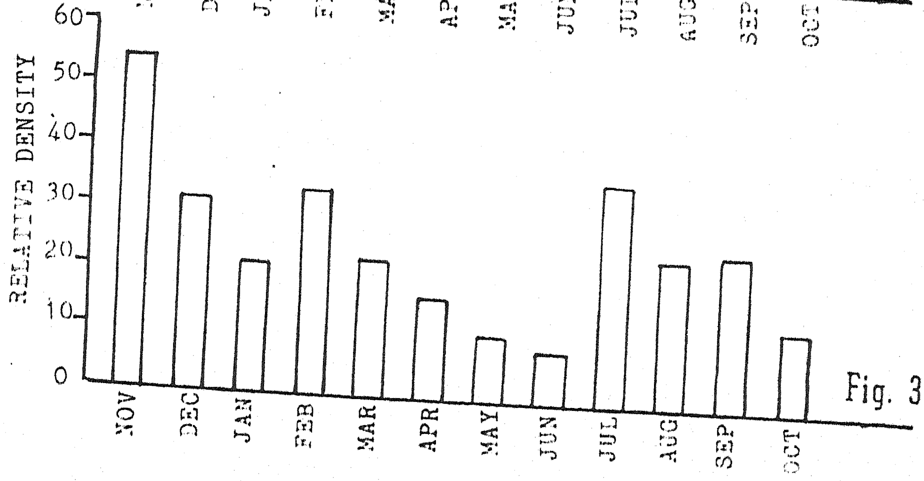
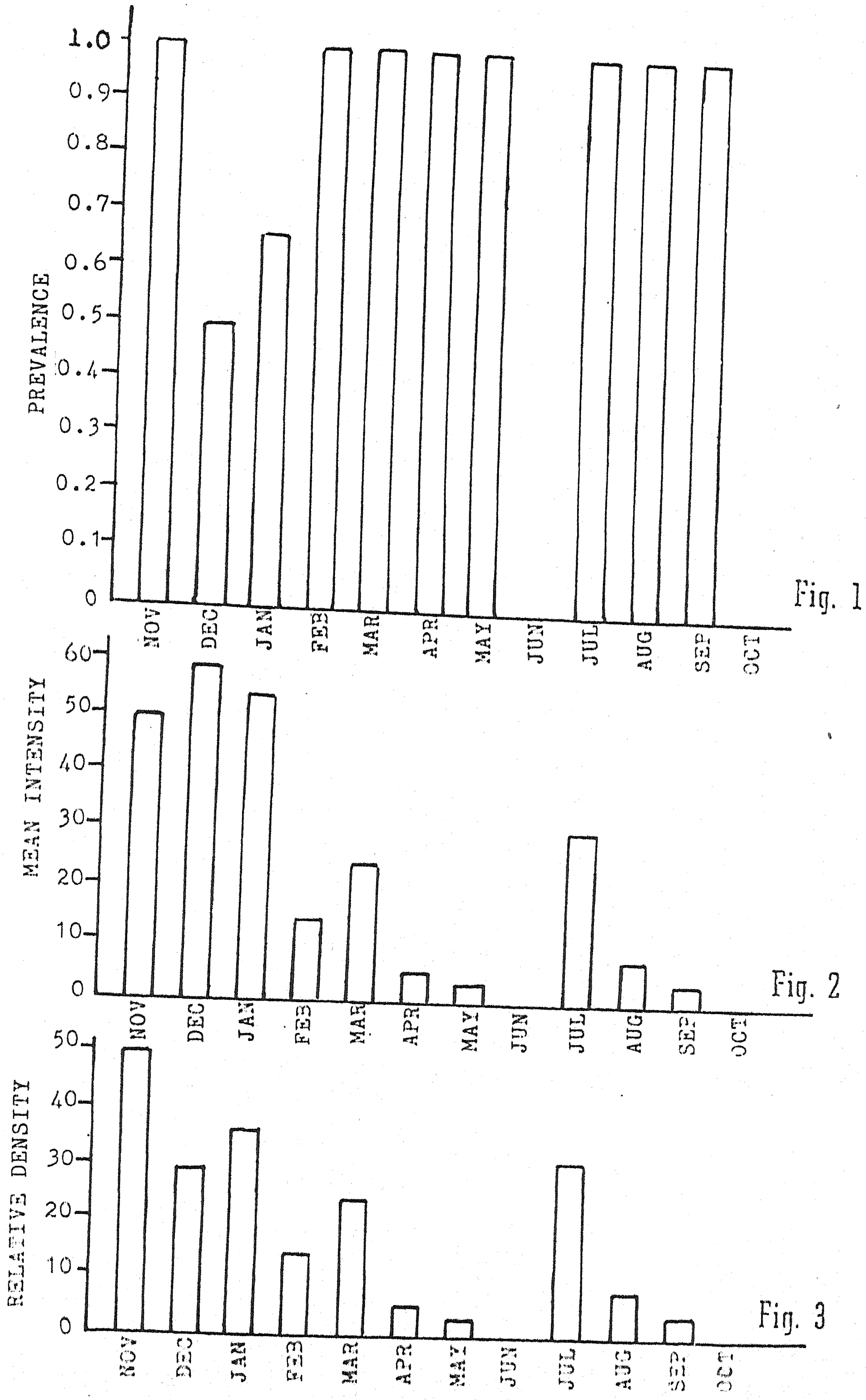


Fig. 3

61-85gm.

PLATE 39



86-110gm.

PLATE 40

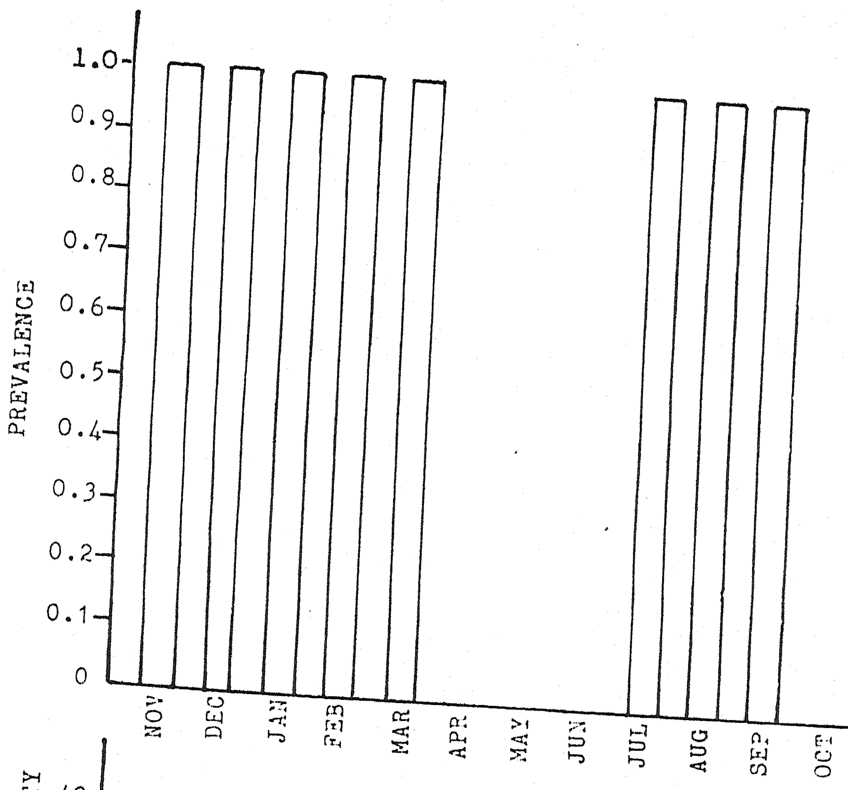


Fig. 1

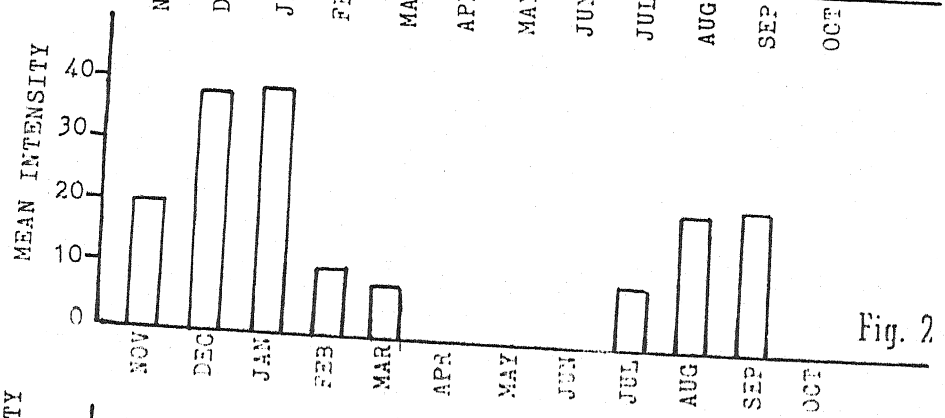


Fig. 2

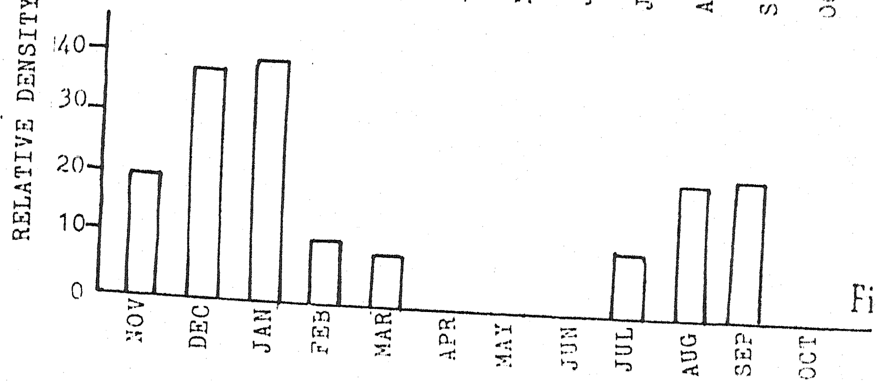


Fig. 3

111-135gm.

PLATE 41

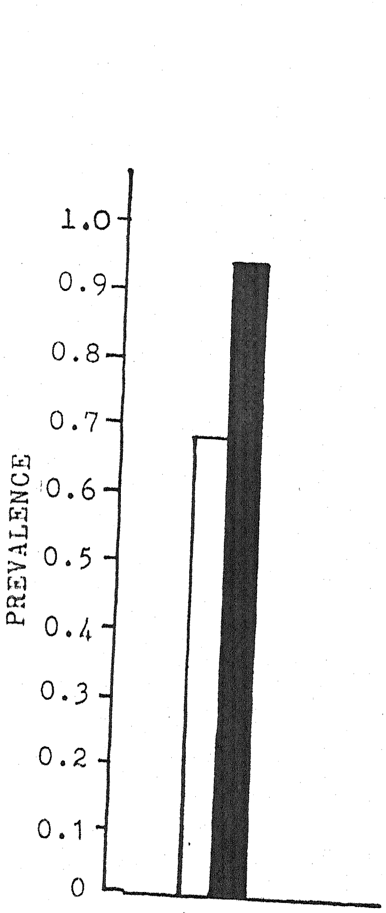


Fig. 1

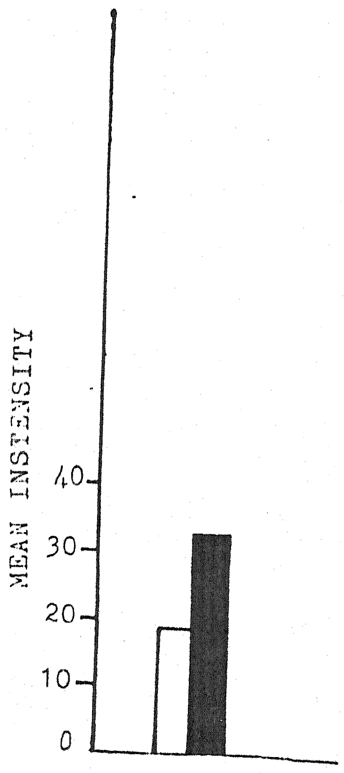


Fig. 2

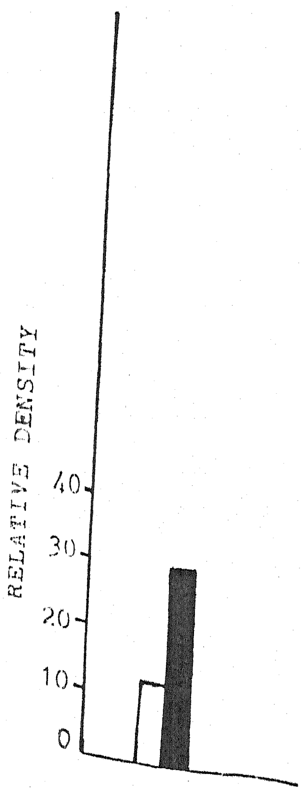


Fig. 3

PLATE 42

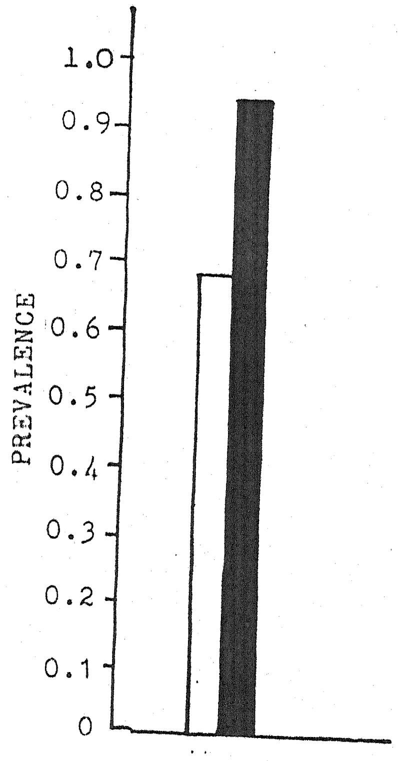


Fig. 1

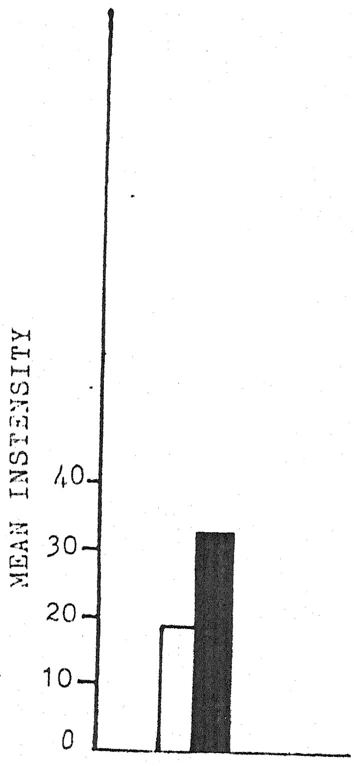


Fig. 2

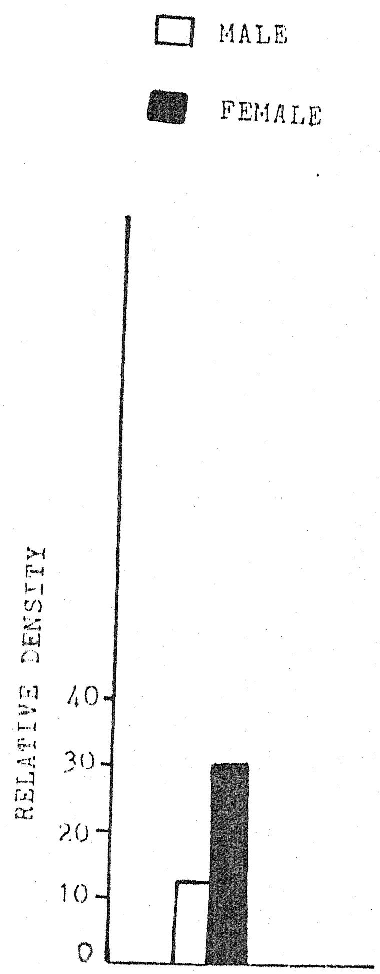


Fig. 3

PLATE 42

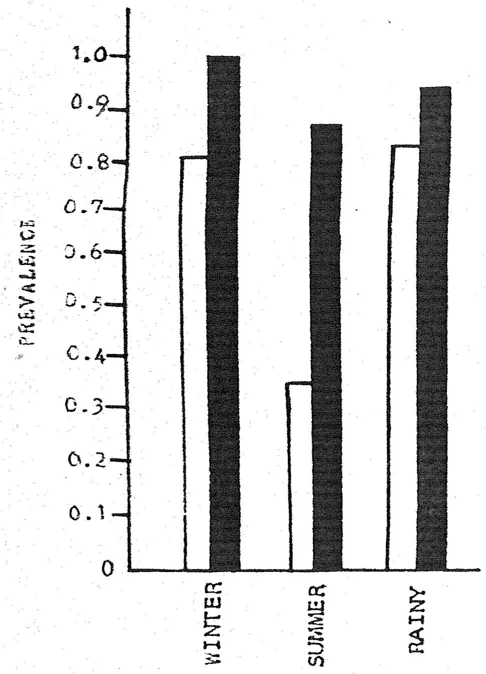


Fig. 1

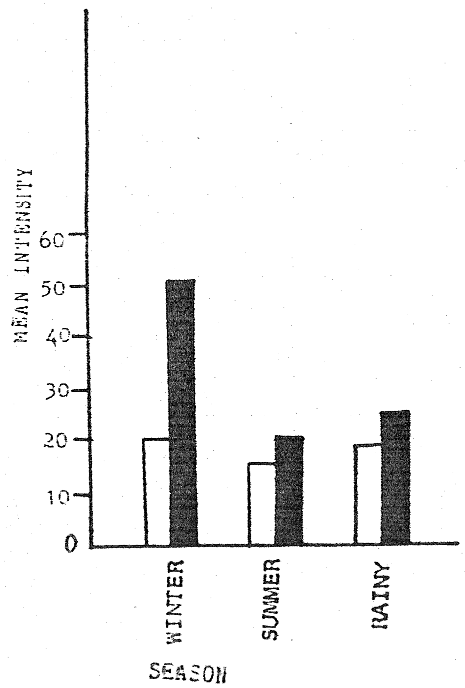


Fig. 2

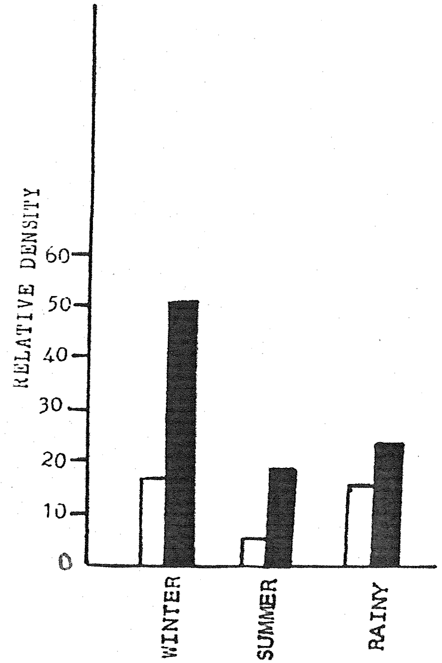


Fig. 3

MALE

FEMALE

PLATE 43

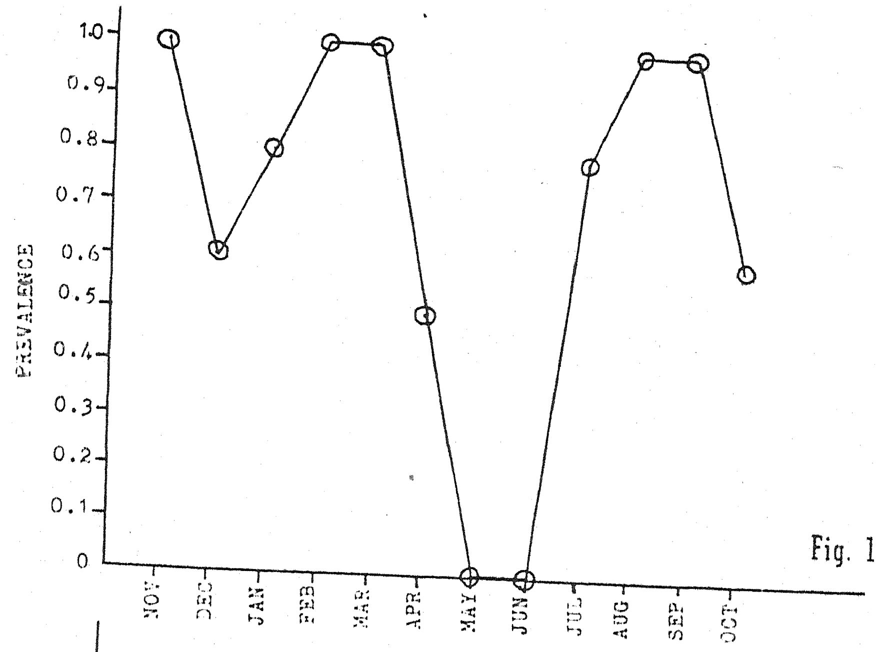


Fig. 1

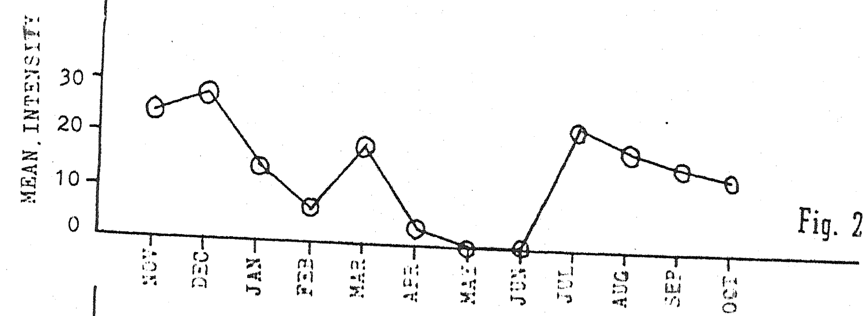


Fig. 2

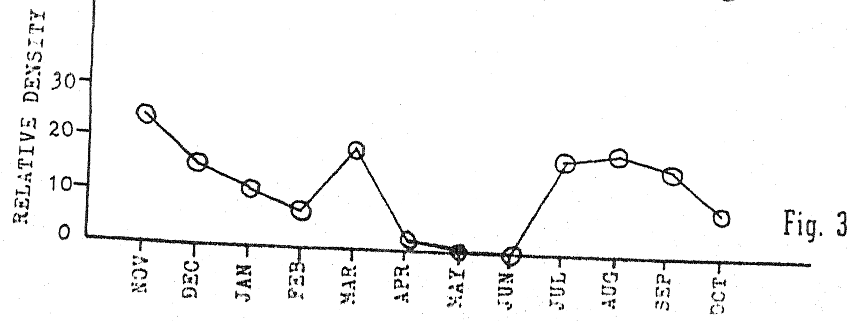


Fig. 3

MALE

PLATE 44

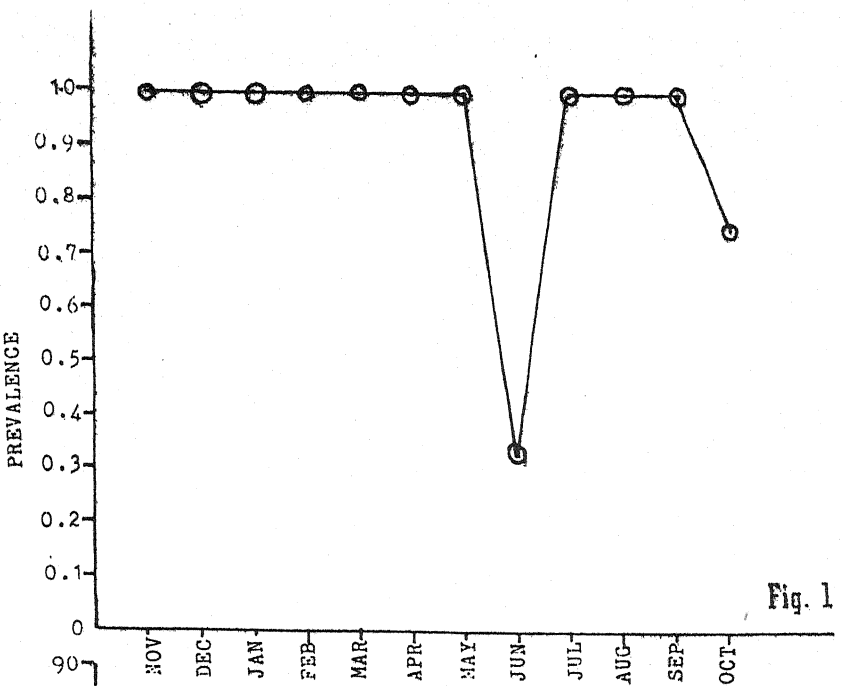


Fig. 1

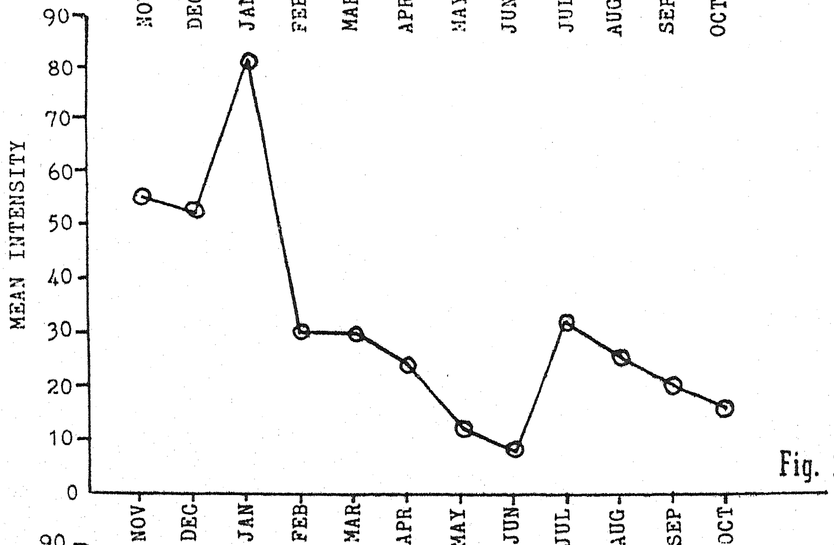


Fig. 2

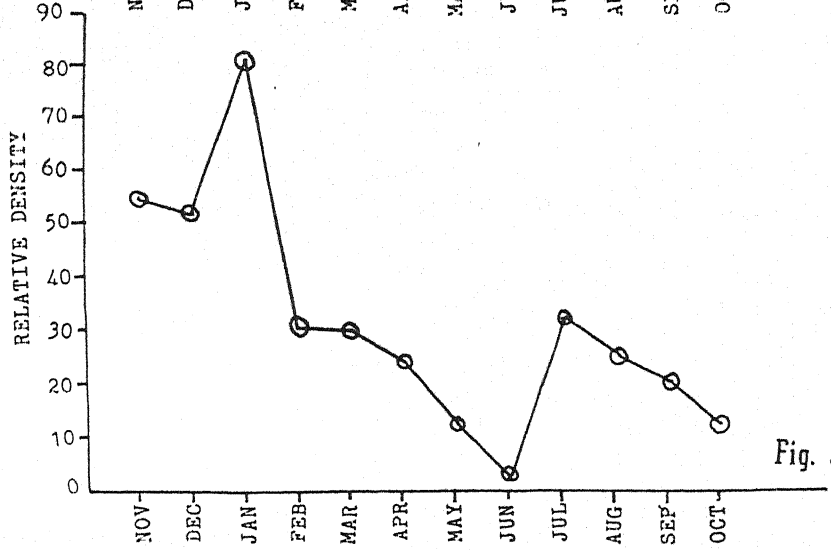


Fig. 3

FEMALE

PLATE 45